SCIENTIFIC AMERICAN

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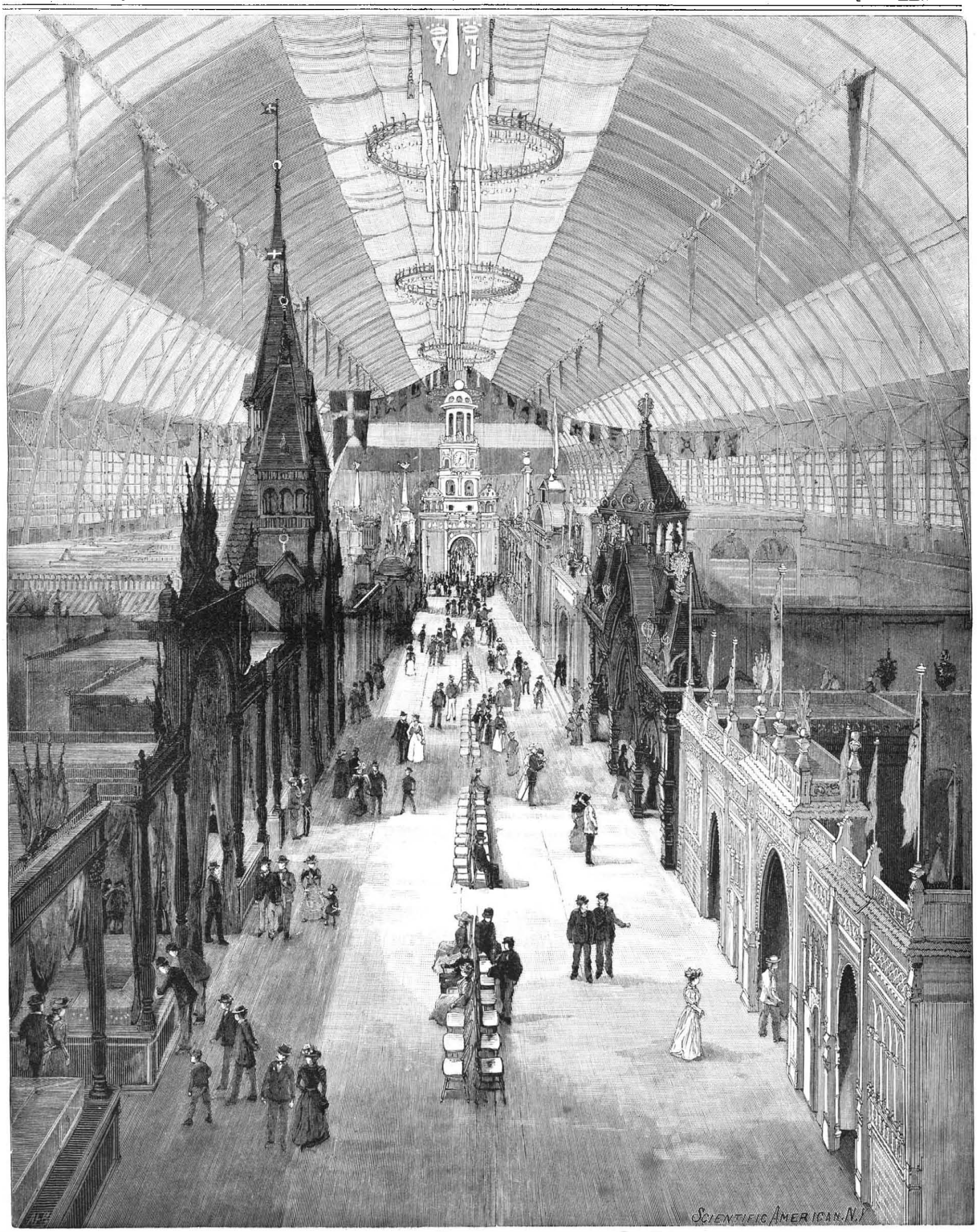

THE WORLD'S COLUMBIAN EXPOSITION—A VIEW IN COLUMBIAN AVENUE PALACE OF MANUFACTURES AND LIBERAL ARTS.—[See p. 119.]

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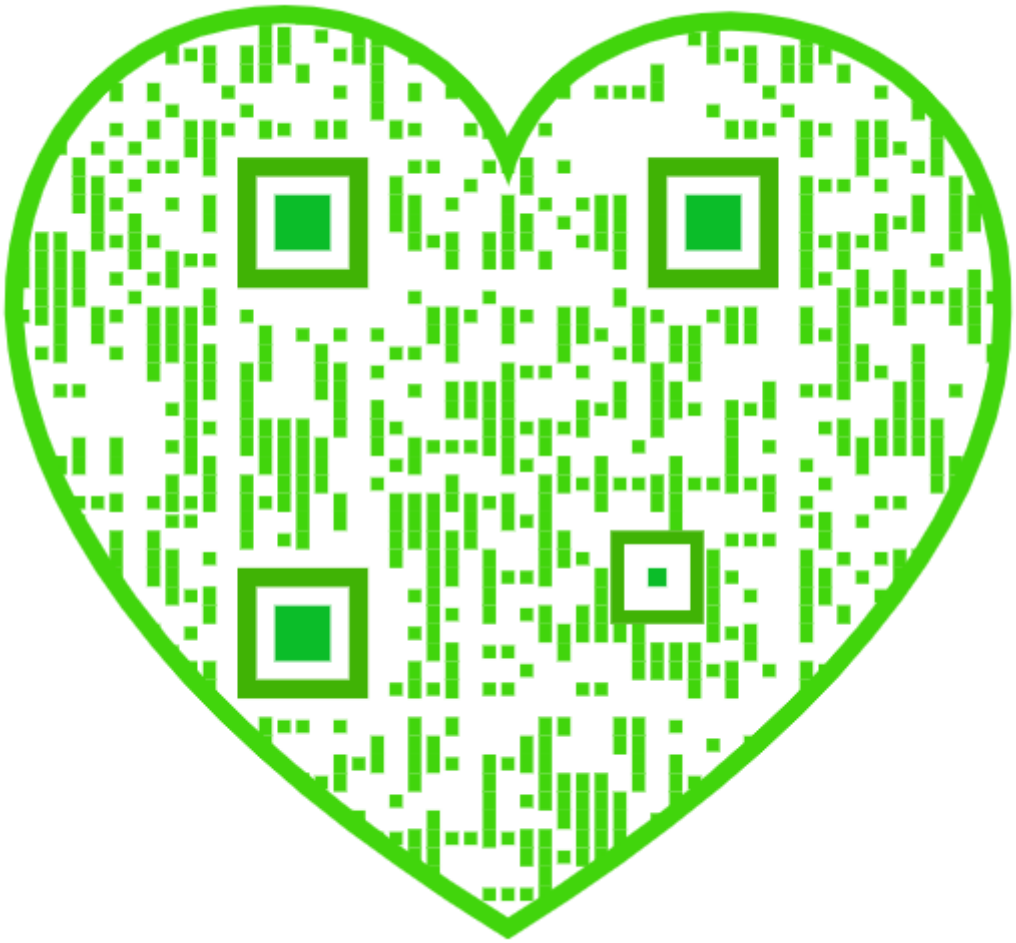

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RAISING VESSELS BY MEANS OF AIR SACKS.

The Glenola, a two-masted schooner, which was sunk about six months ago in Great South Bay, N. Y., has been successfully raised by means of air sacks. Although the principle involved is old, Messrs. Grant Bros.' air sack system of raising vessels seems to be practically successful. Divers descended into the hold and adjusted huge canvas bags or sacks, which measured twenty by four and one-half feet. Each sack was connected by hose pipes to a powerful air pump, and gradually inflated by air. The gradual inflation of the bags with air slowly lifted the vessel to the surface. It required only about one hour to raise the Glenola after the work of adjusting the bags had been finished. The cost of raising vessels on this plan is quite small. In this case the expense was $1,500 to $2,000, and required the services of sixteen men. The system has been used successfully in Puget Sound in raising the Premier, an 800 ton vessel.

WATER POWER TRANSFORMED INTO LIGHT.

Among the notable industrial enterprises recently inaugurated in Mexico is the electric lighting of the city of Guadalajara. The plant utilizes the famous Juanacatlan waterfalls, which are situated about 18 miles from Guadalajara. The Thomson-Houston generators are actuated by Leffel turbines, the head of water being 58 feet. Three turbines of 550 horse power are used. The dynamos for arc lighting have a capacity each for 50 arc lights of 2,000 candle power. The current strength is 10 amperes, and consequently the maximum voltage is 2,500. The incandescent dynamo consumes about 750 horse power and yields approximately 350 amperes at 1,000 volts, or say 350 kilowatts. The voltage is increased from 1,000 to 5,000 volts by means of ten step-up transformers. They transform the energy of the dynamo at an efficiency of about 98 per cent, delivering to the line, therefore, 98 per cent of the energy supplied them and at five times the pressure. The high potential incandescent circuit is reduced to 1,000 volts by step-down transformers at Guadalajara, 17 miles away from the source of electricity.

The installation of the San Antonio Light and Power Company, of Pomona, California, possesses many features of interest. The current is carried twenty-eight miles under the enormous pressure of 10,000 volts. The generators are of the standard 120 kilowatt, 12 pole, 1,000 volt Westinghouse alternator, which delivers current at 7,200 alternations on being driven at 600 revolutions per minute. The generators are coupled direct to Pelton water wheels, the head being 395 feet. The 1,000 volt current is taken to the switchboard and from there to the bank of step-up transformers, from which the current is delivered under a pressure of 10,000 volts. One circuit is carried to Pomona, fifteen miles, and the other to San Bernardino, twenty-eight miles away. The wire used is No. 7 B. & S. hard-drawn, bare copper wire, and is carefully supported on poles by insulators specially designed for this plant. A potential of 9,500 volts is received in Pomona and 9,000 in San Bernardino. The potential on the city lines is maintained at 1,000 volts.

AERIAL NAVIGATION.

During recent sessions of the World's Congress Auxiliary at Chicago, a special branch of the department of engineering known as the aerial navigation conference afforded the occasion for a most interesting presentation of facts and comparison of views of the most experienced experimenters and the best equipped scientists who have given this subject their attention. The conference was organized and actively promoted by Mr. Octave Chanute, the eminent engineer, assisted by Prof. A. F. Zahm, of the Notre Dame University, of Indiana, and the reading of papers and discussions occupied four sessions.

At the outset it was manifest that there was a general indorsement of Mr. Chanute's views, that, difficult as was the problem of aerial navigation, there was still enough of promise in it to lead men, through patient and intelligent inquiry and research, to hope for ultimate good results. The mere purpose of carrying passengers and heavy loads of freight was dismissed as being quite impracticable, for it was not likely that the railway and the steamboat would ever be competed with successfully by air ships, however efficient they might be. But there were many and important uses for an air vessel that could be sailed and controlled at the will of man, as in cases of war and in the study of meteorology.

One of the most interesting papers presented at the first session was that by Prof. Langley, secretary of the Smithsonian Institution, Washington, D. C. (read by Prof. George E. Curtis of the same institute), under the title of "The Internal Work of Moving Air." In this paper Prof. Langley recorded his observations during several years of soaring birds, such as the buzzards, from which he draws the conclusion that flying machines can be made to imitate this flight and to sail in the air when the latter is in movement as easily and with as evidently little effort as the soaring birds. It is worthy of note to find that in two other papers presented at the second session the same kind of studies were recorded and similar conclusions presented by observers in Europe and Africa, one being on "Gliding Flight," by J. Bretonniere, engineer and observer, Constantine, Algeria, and the other on "Theory of Soaring Flight," by Chevalier de Louvrie, engineer, of Combebigu, France. Other papers bearing relation to the above were presented, one on "Observations of Birds," by G. Crosland Taylor, F.R.G.S. and A.I. E.E., of Helsby, England; another by the same author on "Theories of Soaring and Sailing," and another by A. M. Wellington, editor of the *Engineering News*, of New York, on a "Theory of Sailing Flight."

In regard to the construction and propulsion of the future air ship, Dr. R. H. Thurston, director of Sibley College, Ithaca, N. Y., read a most interesting paper on "Materials of Aeronautic Engineering," in which he gave facts regarding the strength of metals, some of which were new even to the scientific men in his hearing. He showed that of all metals steel combined most strength with lightness, and was, therefore, better fitted for the construction of air vessels than any other.

The subject of kite flying was taken up, and the paper on "Experiments with Hexagon and Tailless Kites," by W. A. Eddy, experimenter, of Bayonne, N. J., illustrated by drawings on the blackboard, was a most interesting one. He had succeeded by his method in flying kites to a height of over 4,000 feet.

Papers on ballooning were read by Mr. C. E. Myers, aeronautical engineer, of Frankfort, N. Y. These were "Manufacturing Hydrogen Gas Balloons," "Natural Gas Balloon Ascensions," "Maneuvering of Balloons," and "Balloon Meteorology."

A paper on "Flotation *vs.* Aviation," by Prof. De Volson Wood, of Stevens Institute, Hoboken, N. J., in which the professor advocated a departure from the bird method in flying machines, provoked some discussion, in which the bird method was ably advocated.

Gen. W. Hutchinson, of the British army, Silverdale, England, submitted a published paper on "Design of Navigable Balloons." This was an old idea of Gen. Hutchinson's, and related to the employment of balloons in warfare.

One of the most interesting of the papers read at the conference was by Prof. Mark W. Harrington, but it had reference rather to the work of the government weather bureau than to the navigation of the air, and advocated the establishment of special balloon and kite stations for observational purposes.

Prof. A. F. Zahm, secretary of the conference, whose subject was "The Stability of Aeroplanes," presented descriptions of a variety of models with which he has experimented with a view to securing automatic equilibrium and steadiness of flying machines in all circumstances of wind and calm. He defined the aeroplane as the supporting surface of a flying machine as distinguished from the propelling surface, and stated as some of its requirements, (1) that it should, when launched in any manner, automatically head to the wind and move rapidly forward; (2) that when displaced or overturned it should promptly recover its position of equilibrium; and (3) that it should maintain a prescribed and uniform average position and course in the air, as a boat does in the water. The models described comprised various forms of gravity kites. dirigible parachutes and simple and compound aeroplanes.

Sweet Pickled Watermelon Rinds.

A writer in *Harper's Bazar* gives the following directions:

Peel the rinds with a sharp knife that will take off the green skin evenly. Trim off also every trace of the pink flesh of the fruit, because it is too juicy to make a firm, crisp pickle. Then cut the strips of rind into small pieces, two to three inches long, and placing them in a large earthen dish, sprinkle them lightly and evenly with salt. Cover the dish and let it stand overnight. In the morning drain off the water that will have formed, rinse the rinds in cold water, and cook them in a steamer until a broom splint will readily pierce them. Cooking the rinds by steam is an easy method, as they are less liable to burn than when cooked in the spiced vinegar. When the rinds are tender, take them out carefully with a skimmer and put them into a stone jar.

Take good cider vinegar for the basis of the pickle. Allow a pound of sugar to a pint of vinegar, and add also half an ounce of stick cinnamon broken into inch pieces, and a half teaspoonful each of wholecloves and blades of mace. The whole amount of vinegar, sugar, and spices used must, of course, depend on the quantity of rinds to be pickled, but a quart of vinegar is usually sufficient for the rinds of a medium sized melon. Boil the vinegar, sugar, and spices together vigorously half an hour, skimming off the froth, and pour the pickle boiling hot over the rinds. Press the rinds down under the pickle by means of an earthen plate or saucer, fasten the cover on, and tie a cloth over the whole These pickles will be ready for use in two weeks.

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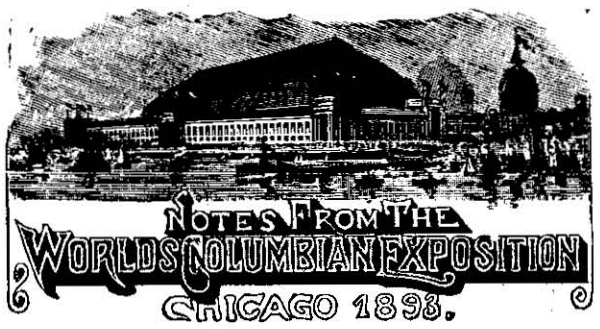

The Indian School exhibits, made by the United States government, are both interesting and remarkable. One school comes and stays nearly a month, then another, and so on, until each one has exhibited in turn. The exhibit during the early part of August was that of a Haskell Institute, at Lawrence, Kansas. Forty-six scholars werein attendance—thirty-one boys and fifteen girls, and these scholars represented twenty-three Indian tribes. A brass band of twenty-four pieces, composedentirely of boys in this school, played each morning at half-past nine. There was a constant stream of visitors passing through the school. One day's record was 21,000 people, and the first eleven days 146,500 people visited it. The display includes an exhibit of the work of the pupils in various stages of education, from the kindergarten to painting, drawing, and various occupations. The boys are at work making shoes, harnesses, clothing, carpenter work, etc. Many fine, strong faces are to be seen among the children of these schools.

Bark wigwams of the Crees and allied Indian tribes of the Northwestern Territory of Canada are shown, and there are several families in connection with this exhibit. The State of Maine sends as exhibits several families of Penobscot Indians, who have erected birch bark wigwams, in which they live and sell specimens of their handiwork, such as baskets and head work. The Winnebagos and Chippewas, from Wisconsin and Minnesota, are represented and occupy typical houses of hides and bark. Other Indian habitations are shown, of Tepees, Hogans, Navahos, Apaches, and other Western tribes. Three wooden huts are occupied by Quackuhl Indians, from Vancouver Island. In front of each is an immense totem pole, carved in grotesque fashion.

The State of New York represents the Six Nations, the Iroquois, Senecas, Mohawks, Onondagas, Cayugas, Oneidas and Tuscaroras. The confederation of these tribes, declared by Daniel Webster to be the most consummate piece of statesmanship in the history of the world, dates back many generations. Although the present representatives of these nations live like ordinary citizens in houses of wood or stone, many reminders of these early days are still carefully preserved. The Long House, built here at the Exposition, is an exact reproduction of the one that formerly stood on the site of the city of Albany, N. Y. It is forty-five feet long and twenty feet wide, and is constructed so that three apartments can be arranged on each side with a passageway through the center in which the council fires were built, one between each opposite pair of rooms. This building is constructed exactly keeping with the primitive style, not a nail or a pin being used in it—withes of hickory or slippery elm being used. This structure is utilized as a salesroom, and many of the manufactures of these Indians are to be had here, all of them being made on the spot. The hereditary chief of the Six Nations must be a member of the Onondaga Tribe. This man, called in the native tongue Otataho, is Daniel La Forte. Mr. La Forte speaks English with perfect fluency, and is equally proficient in the tongue of each of the Six Nations, so that at the council meetings he is able to understand all that is said by a representative of any tribe, and if need be, can answer him in the same tongue. The first chief who arrived at the Exposition was Chief Luther Jack, who took an important part in the reception to the hardy mariners of the Columbus caravels and the Viking ship. The accompanying illustration represents this chief with squaws of the same tribe seated in front of the railing surrounding the Basin, waiting for the reception to begin. Another important representative of the Six Nations is Thomas Webster, who is the chief wampum keeper.

The bark used in covering the Indian houses here shown is usually of basswood or elm. These structures represent the type of dwellings occupied by the members of the Six Nations at the time white men first came to America, and as a background to it there is shown near by a log cabin, which is an exact reproduction of the general type of cabin occupied by the early settlers of this country, This house is furnished in an exact reproduction of the early days, with a hand loom, spinning wheel, and all other furniture.

The two distinctive engineering concessions, that is the Ferris Wheel and the Movable Sidewalk, are proving very popular and give every indication of being among the most successful concessions in the Exposition grounds so far as financial returns are concerned. The wheel has an average daily attendance of eight or ten thousand people, and at this rate it will not only pay for itself, but probably give the stockholders a large dividend.

Tablets commemorative of the great work done at the Exposition by John W. Root, the architect, who did so much toward laying out and planning the Exposition, and to Henry Sergeant Codman, the landscapist, who laid out the grounds, have been placed on the south front of the Fine Arts building. These tablets are offered by friends and associates of these two eminent men, all of whom worked together in the early days of the Exposition, and who perfected and carried out the marvelous work as now seen.

CHIEF LUTHER JACK AND SQUAWS OF THE SIX NATIONS.

A remarkable exhibit in the Mining building is that of "carborundnm," a new compound, which is made by combining silica and carbon by means of electrical action. This product possesses such remarkable grinding qualities that it cuts glass and polishes diamonds. Its abrasive qualities are believed to be greater than those of any other material, and this is particularly interesting from the fact that is a manufactured and not a natural product.

The week beginning July 31 was devoted to the Engineering Congresses. These included eight divisions, as follows: Civil Engineering, Mechanical Engineering, Mining Engineering, Metallurgical Engineering, Engineering Education, Military Engineering, Marine and Naval Engineering, and Aerial Navigation. The divisions met in general session, when addresses were made. Thereafter each congress met in its own session and listened to the reading of papers and their discussion.

Eminent engineers from all parts of the world were in attendance and contributed papers, adding greatly to the value of the congresses.

In the Civil Engineering department the opening address was delivered by William Metcalf, president of the American Society of Civil Engineers. Papers were offered by eminent engineers from France, Portugal, Germany, Holland, Canada, Mexico, Great Britain, Italy and from the United States and the army and navy. These papers discussed work in all lines of civil engineering, highways, railway matters, the construction of bridges, the building of canals, etc. Several of the most interesting and important engineering works now under way in various parts of the world were described by engineers cennected with them.

The Mechanical Engineering Congress was opened by an address from Mr. E. B. Coxe, president of the American Society of Mechanical Engineers.

President Henry M. Howe, of the Institute of Mining Engineers, opened the Mining Congress. Thisdivision and the Metallurgical held a joint session. Mining schools were pretty thoroughly considered and various papers were read discussing mining and geological subjects.

Prof. Ira O. Baker opened the Congress of Engineering Education, and at the several sessions papers were read by professors representing the leading engineering schools of this country and Europe.

The Congress of Military Engineers opened with an address by Major Clifton Conly of the United States army. Prominent engineers and army officers attended and important papers were read discussing coast and other defenses, torpedoes, submarine work, fortifications, roads and bridges, transportation, the handling of troops, modern guns, and explosives.

Commodore George W. Melville, chief engineer of the United States navy, opened the division of Marine and Naval Engineering. In this congress, naval architecture and all matters pertaining to the construction, building, and equipping of vessels were fully discussed, papers being presented by engineers from varions foreign nations as well as from engineers from the navy and leading shipbuilding concerns of the United States.

In the division of Aerial Navigation, Mr. Chanute delivered the opening address and many papers were presented. The subject of aerial navigation was discussed more freely and completely than ever before.

The members of the congresses visited the engineering works about the city of Chicago and inspected the work now in progress on the great drainage canal, which is expected to afford wholesome drainage for the city.

When I came to Chicago I was prepared to see a great Exposition, but I found it was even greater than my imagination could picture it. One walks all day seeing and studying and examining with much earnestness, only to be disgusted at night because the day's work counts for so little in comparison with what there is to see. The exhibits are almost numberless, the areas of the building are estimated in acres; and because of the bigness of everything it is necessary to do a great amount of walking. In every direction there is something particularly to attract the eye. Nothing seems to be lacking that could add to the completeness of the picture. I am overcome by the conception of the Exposition and the lavish magnificence with which it is carried out, and it makes my patriotism simmer with pride to feel that this is a thoroughly American undertaking and is held in the bosom of the country.

Among the things that seemed strange to me was the number of wheeled chairs constantly moving about. I was not surprised to see a good many women riding, but at first I thought there must be an abundance of lazy men at the Exposition. After I had tramped vigorously two or three days and used myself up without seeing but a small part of the Exposition, I was not surprised that there were so many apparently lazy men. Even a professional pedestrian would find it a hard task to tramp about these buildings and grounds from early morning until late in the evening and not get used up. Another oddity is a little red camp chair of simple and almost crude construction which many people carried. These are hired for the day and can be returned at any booth. It is some bother to carry these chairs about, still they repay their cost of ten cents a day many times over.

(Continued on page 119.)

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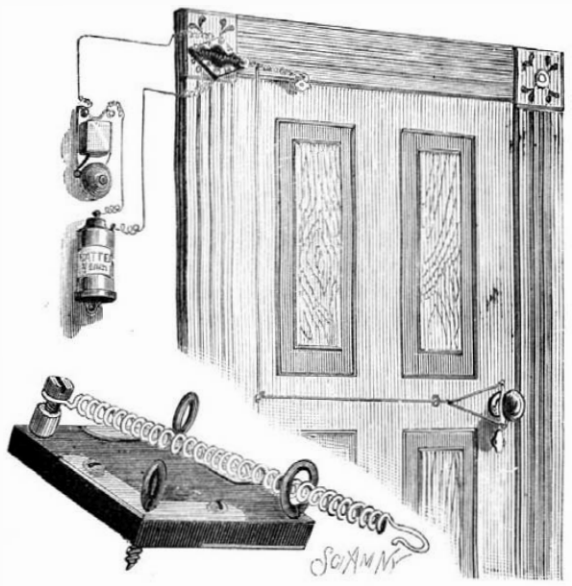
A READILY APPLIED BURGLAR ALARM.

The device shown in the picture may be conveniently applied to a door or window, trunk or bureau drawer, etc. It has been patented by Mr. Charles J. Fisher, of No. 90 Evergreen Avenue, Chicago, Ill. A diamond-shaped base plate of insulating material has on its opposite sides conducting plates, as shown in



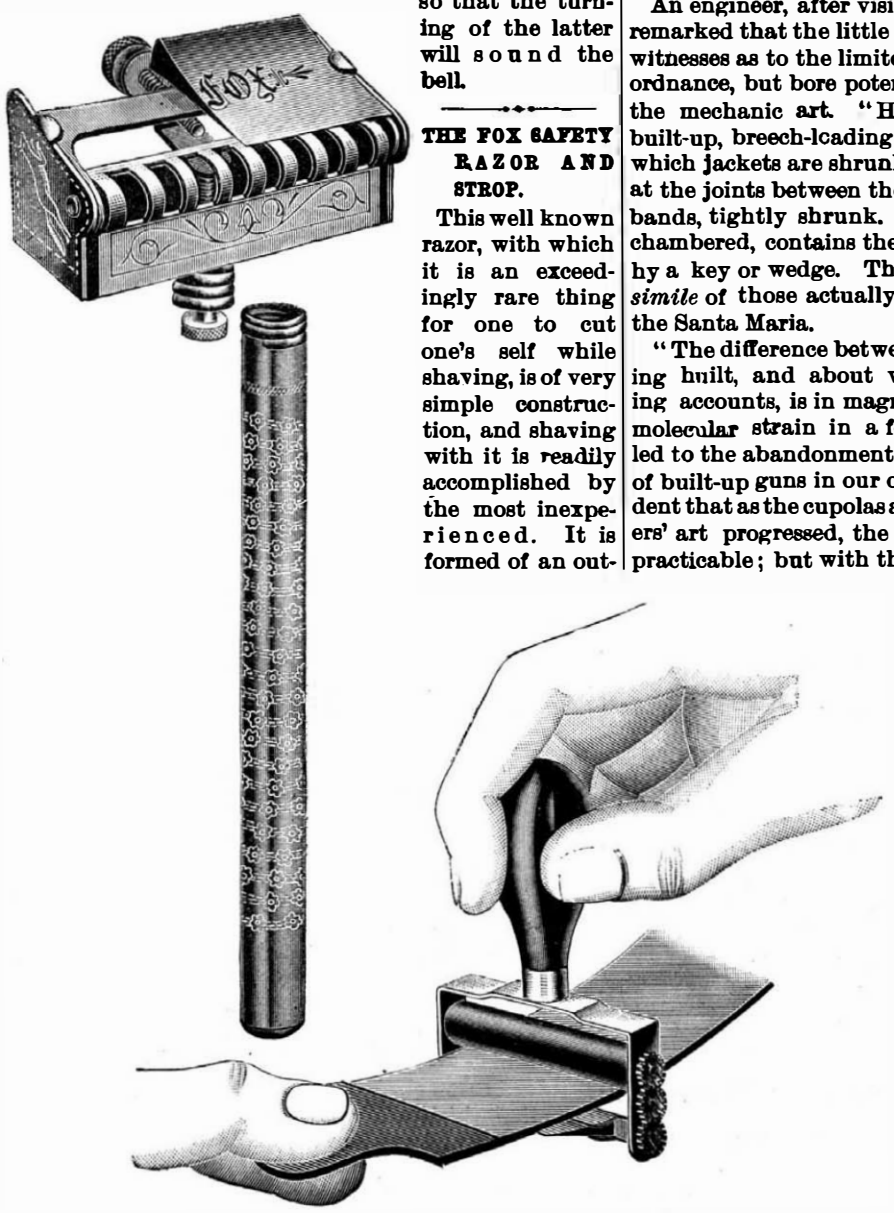
FISHER'S BURGLAR ALARM.

the small figure, the center of each plate having an opening for a screw, and these screws being conductors. A third screw at one end is connected with one end of a spring which extends over the base and passes through a metal eye, the body of which is carried through to the bottom of the base, on the under surface of which are oppositely disposed conducting plates, one connected with the screw to which the spring is attached, and the other with the eye. The base plate is attached to any object by passing screw eyes or like fastenings through the side apertures, the positive and negative wires of the battery being connected with the eyes, and a bell being located in the circuit. Then, as long as the spring extended over the base remains in the middle of the eye the circuit will be open, but the engagement of the eye by the spring closes the circuit, as all of the plates, the spring and the wires of the battery are in connection, and the bell will be sounded. In the application of the improvement as shown in the illustration, the door needs to be opened only slightly to force the spring into contact with the guide eye, and thus give an alarm, while the device may be also connected with the door knob, so that the turning of the latter will sound the bell.

THE FOX SAFETY RAZOR AND STROP.

This well known razor, with which it is an exceedingly rare thing for one to cut one's self while shaving, is of very simple construction, and shaving with it is readily accomplished by the most inexperienced. It is formed of an outside frame and guard in one piece, two inches long, in which is inserted the razor blade, one and seven-eighths inches long, and the removable handle. Within the outside frame is another movable frame which presses against the blade when inserted, the blade being quickly adjusted in correct position by means of two screws.

A special patented device for stropping and honing is shown in one of the views. The blade is held in the bottom of the frame holder, through which is passed the swing strop under the friction roller, and the device is then moved forward and back over the strop, on which the roller slightly presses, the blade being automatically turned on its back with each reverse motion of the device on the strop. The strokes may be short or long, quick or slow, but it is quite impossible to cut into the leather, and a fine, keen edge may be quickly obtained. M. E. Lothair Schmitz, No. 92 Reade Street, New York City, is the patentee and manufacturer of these devices.

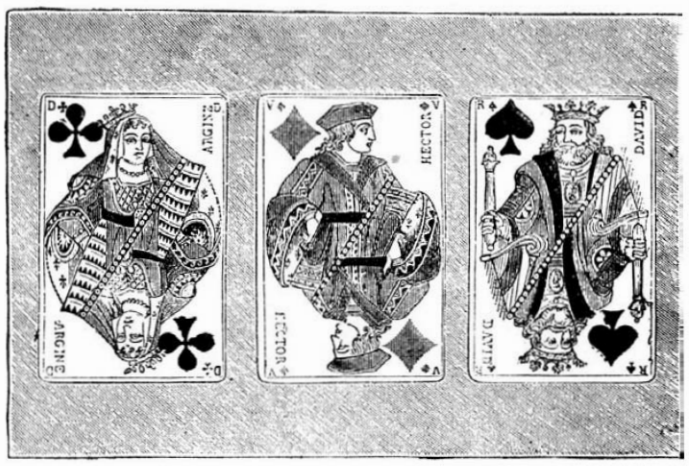


THE FOX SAFETY RAZOR AND STROP.

AN EXPERIMENT IN DIVINATION.

I place before your eyes three face cards, a queen of clubs, a jack of diamonds and a king of spades. During my absence in a neighboring room, whence it will be impossible for me to see you, you will turn one of these cards upside down. When you call me, I will tell you which of these cards you have thus inverted. It is unnecessary to say that one must operate with double-headed face cards that have absolutely the same aspect in both directions.

The following is the manner in which the operator can recognize the card inverted. He selects from the pack three cards in which the line engraved around the card is nearer the edge at one extremity than at the other. He places the three cards upon a table before the spectators in such a way that the wider margin of the card is at the bottom with respect to the spectators and the narrower at the top, as is the case with the three cards represented herewith. The three top margins are narrower than the bottom ones. This is especially perceptible in the king of spades, but is very apparent also in the two other cards, which are accurately reproduced from a photograph. When a card has been inverted, it is easy to perceive it in noticing that the wider margin is at the top with respect to the spectators. The difference in width of the two margins is very appreciable to the operator, but escapes the eyes of the spectators who are not posted. This amusing experiment never fails to excite astonishment.—*Dr. Z., in La Nature.*



A TRICK WITH CARDS.

The Ancient and the Modern Gun.

An engineer, after visiting the caravel Santa Maria, remarked that the little guns of that vessel were silent witnesses as to the limited advance in the science of ordnance, but bore potent testimony of the advance in the mechanic art. "Here," said the engineer, "is a built-up, breech-loading gun; it has a central tube, on which jackets are shrunk (or forced) in short sections; at the joints between these sections there are other iron bands, tightly shrunk. The breech block, which is chambered, contains the cartridge; it is held in place hy a key or wedge. This gun is certified to be a *facsimile* of those actually used by Columbus on board the Santa Maria.

"The difference between this gun and those now being built, and about which we read such interesting accounts, is in magnitude, not in principle. The molecular strain in a forging or casting of great size led to the abandonment of cast guns and the adoption of built-up guns in our own generation. It seems evident that as the cupolas advanced in size and the moulders' art progressed, the cast guns of large size became practicable; but with the increased internal pressures demanded the castings reached their limit, and built-up guns became essential.

"The gun of to-day is composed of a central tube, on which are shrunk 'hoops' in shorter sections. Its breech block is held in place by a slotted screw, which is but another form of the wedge, being a circular inclined plane.

"The difference between the guns of Columbus' ships and those of to-day is due almost exclusively to the mechanic arts; to the steam engine as the power; furnaces, the cupolas, the hammers, and the lathes as the tools, and to the brawny sons of toil who work these machines. The advance has been gradual, and is wrought by mechanics and draughtsmen, and the claim that gunnery or that ordnance belongs to the occult science pales before the scrutiny of common sense observation."

A Selenite Mine.

At a recent meeting of the Royal Microscopical Society, Dr. J. E. Talmage, of Salt Lake City, Utah, exhibited and gave an account of some specimens of selenite found in the interior of a mound at South Wash, near Fremont River, Utah. As a rule, portions of selenite useful for optical purposes are measured by inches and weighed by ounces, but here he had found some which weighed 1,000 pounds. The formation around the mound was mostly sand and clay, and the region bore everywhere strong evidences of weathering, by means of which the mound had been weathered out into relief. He had removed some twenty tons of the crystals, among which were many single crystals, measuring 4 to 5 feet in length, and entirely perfect, the most regular being 4 feet long, with faces of 6 inches. One fine crystal, 5 feet long, had no less than nineteen small ones jutting out from it; twins and groups were also very common. Inclusions of sand, clay, and liquid were often present.

A RAILWAY CATTLE GUARD.

The illustration shows a simple and inexpensive apparatus for application to a cattle gap, to prevent cattle from getting their legs caught between the sleepers above the gap, and also to prevent their passing over it, and to frigbten them away. The improvement has been patented by Mr. Lorenzo Hills, of Pittsburg, Texas. The part of the gap on which the cattle are likely to approach is covered by a vertically movable platform extending beneath the rails, and hinged at one edge, the sleepers being recessed to provide for the limited up and down movement of the platform. On the under side of the platform is a cleat carrying a depending arm pivoted at its lower end between parallel tilting arms which oscillate on a shaft supported in hangers. To the inner ends of the tilting arms is fastened a depending brace whose lower end is

HILLS' CATTLE GUARD.

secured to a rod which carries the guard strips, and is adapted when swung upward to project them to the full height necessary to prevent the passage of cattle, as shown in one of the views. The guard strips are preferably of metal, painted some bright color, that they may more efficiently frighten away cattle as they are suddenly thrust upward. When the platform is depressed by an animal stepping upon it, one end of the tilting arms is swung down and the other lifted, thus carrying upward the depending brace and rod, with the attached guard strips. The latter, while of sufficient stiffness to stand upright ordinarily, are designed to bend over under heavy pressure, as in case of a stampede of cattle, when the strips may be pushed down to allow the cattle to pass without injury.

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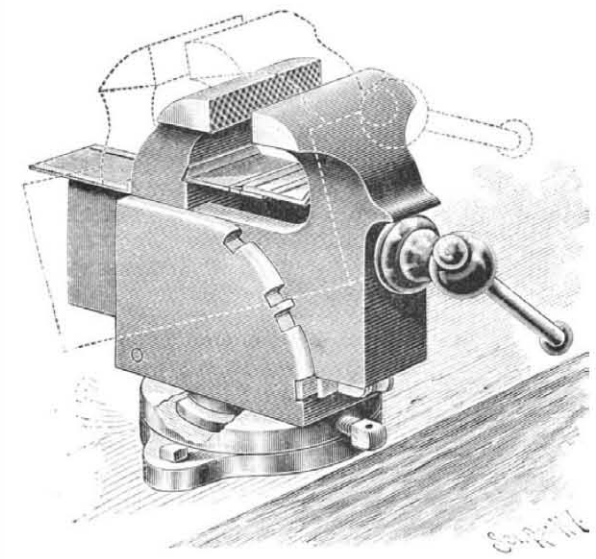
A CONVENIENT BENCH VISE.

The illustration represents a vise which may be readily moved into any desired position to hold the work at different angles to the horizontally moving file in the hands of the mechanic, to facilitate the proper filing of hexagons, octagons, or articles of other shapes. The improvement has been patented by Mr. Abraham Lurie, of No. 330 East Seventieth Street, New York City. In the base plate turns a circular offset projecting from the bottom of a casing carrying the vise proper, which is locked in place by



LURIE'S BENCH VISE.

a set screw. In the rear end of the casing, near its bottom, is a pivot on which is hung the foot of the shank of the fixed jaw, the opposite movable jaw having its shank formed in the shape of a casing fitted between the parallel sides of the outer casing. The bottom of the casing for the shank of the movable jaw has dovetails engaging corresponding grooves in opposite sides of the shank of the fixed jaw, so when the latter is moved into an angular position on its pivot, as indicated by the dotted lines in the illustration, the movable jaw moves with it, without disturbing the relative position of the two jaws, the screw rod at the same time operating to move the movable jaw toward or from the fixed jaw. To lock the fixed jaw in the desired angular position, a locking device, consisting of two L-shaped latches, is attached to its foot, the latches being normally held in an outermost position by a spring, when they engage correspondingly shaped notches in the segmental edge of the sides of the outer casing. The latches may, by pressing inward, be readily disengaged from either set of notches, and the casing carrying the jaws may be turned in its base on loosening the set screw. There are sliding plates between the jaws, and a fixed plate extending rearward from the fixed jaw, to prevent filings from passing into the casing.

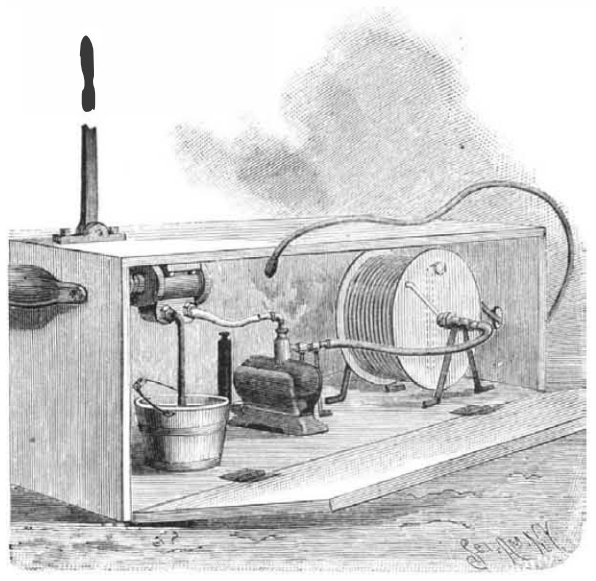
THAWING OUT FROZEN PIPES, ETC.

The difficulties, inconvenience, and sometimes very considerable loss which may attend the sudden freezing up of pipes, drains, etc., have suggested the improvement shown in the accompanying illustration, for the ready thawing out of such conduits, and for which a patent has been granted to Mr. Daniel H. Streeper, of Norristown, Pa. The apparatus is contained in a box, in which a boiler is held over a plumber's furnace, a hand pump at one end of the box forcing water into the boiler through a hose, while a pipe from the boiler leads to a pipe which forms the axle of a drum supplied with water by an independent filling tube. A portion of the pipe forming the axle of the drum is perforated, and it is surrounded by a hollow axle whose ends are closed by stuffing boxes, a pipe leading from one end of the hollow axle outward on one face of the drum to the rim, on which the pipe is formed into a coil, adapted to be unwound from the drum as required in use. The pipe is preferably of lead, but a hose may be employed instead, and on its outer end is a pilot for conveniently guiding the end of the pipe into and through the frozen pipe to be thawed out. For forcing a flexible hose forward in a frozen pipe a rod may be attached to the pilot, or the pilot may be flexibly attached in case the pipe is to pass around curves. In operation the water heated by the furnace is forced by the hand pump from the boiler into the hollow axle, where it heats the water in the drum and the pipe coiled on it, the hot water or steam at the same time passing through the pipe itself, and through the pilot at its end, into the frozen pipe, the coil being unreeled from the drum and pushed into the frozen pipe as the operation progresses.

THE IMPERIAL INSTITUTE, LONDON.

Among all the stately and happy ceremonials of the Queen's Jubilee, none possessed greater intrinsic significance than the recent opening of the Imperial Institute by Her Majesty. That event, as it marked the completion of the idea of showing by a permanent memorial the expansion of the empire during the fifty years of Queen Victoria's reign, was of national importance. To-day a magnificent palace, ample in its proportions as befitting the world-wide empire which it symbolizes, and well adapted for the several purposes for which it is intended, occupies the site at South Kensington made familiar by the series of exhibitions of which the Colonial and Indian Exhibition of 1886 was the last.

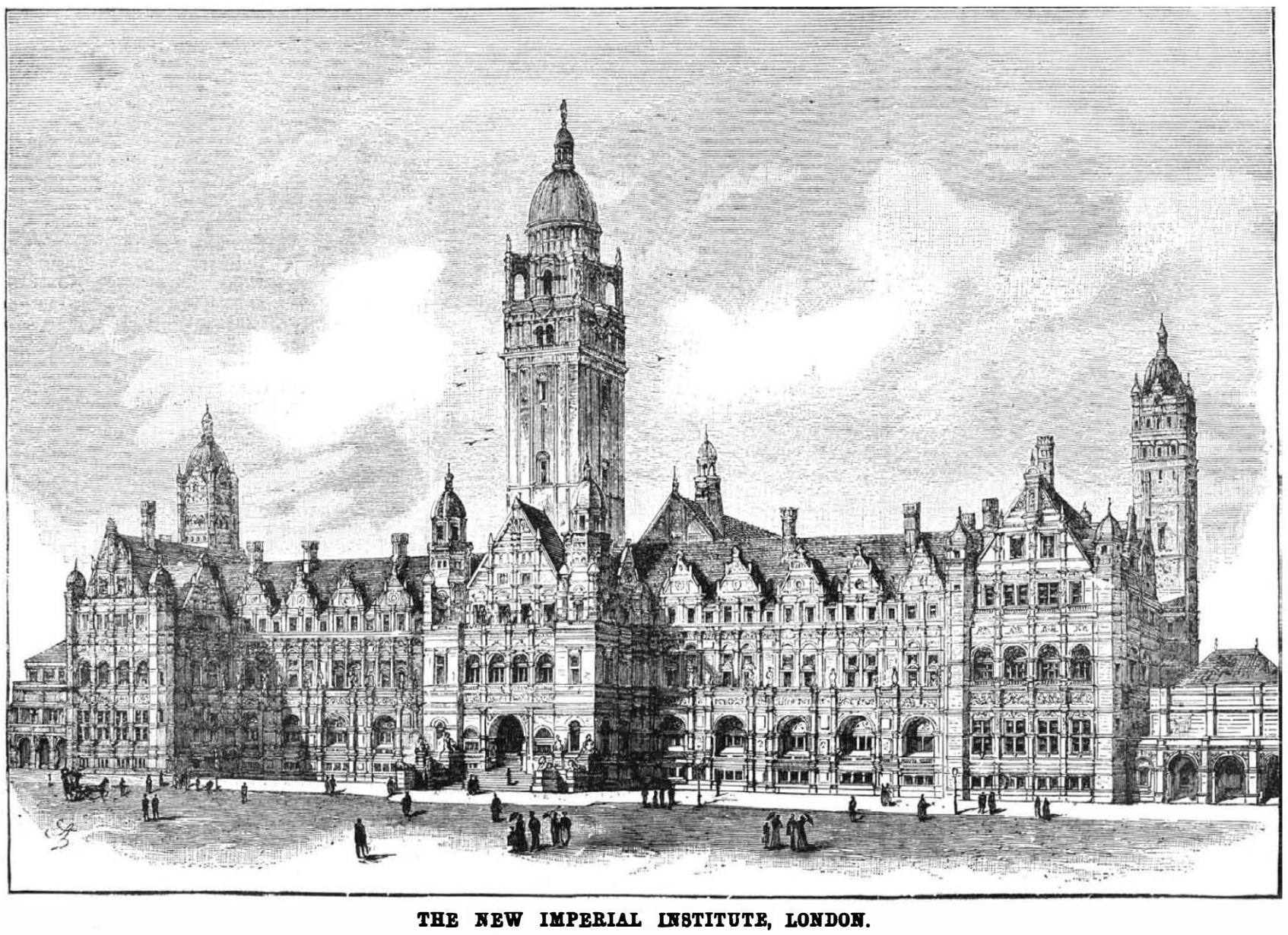
By accepting the advantageous offer of the Royal Commissioners of the first International Exhibition, the owners of the site, the executive of the Imperial Institute have been enabled to devote to the building the greater part of the public funds raised, and a total area of nine acres is now covered with the structure and its courts. Looking down from the great square central tower, one notes immediately on the north side the full proportions of the Albert Hall dome, with the



STREEPER'S APPARATUS FOR THAWING OUT FROZEN PIPES, ETC.

cross of the Prince Consort Memorial rising behind it. The Royal College of Music, also in process of building, occupies the ground between the north gallery of the Institute and the Albert Hall, with the City and Guilds of London Technical Institute adjacent. In front, to the south, the immediate object seen is the Natural History Museum, the ground intervening on the other side of the new wide avenue lying ready for new buildings of the South Kensington Museum, or other public institution, which should harmonize with the surroundings. The trees of Hyde Park and Kensington Gardens, the open spaces, and the glint of the Serpentine form an agreeable contrast to the regular lines of streets and blocks of tall houses—dwarfed from this height, however—which characterize this part of London.

Though the building is to a certain extent shut in by its surroundings, and it is difficult to get an adequate



THE NEW IMPERIAL INSTITUTE, LONDON.

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idea of its actual dimensions, yet no eye can fail to be captivated by the magnificent facade along the north side of the Imperial Institute road. The actual length of the main building is a little over 200 yards, but with the arcades the whole frontage presents one long line of 300 yards.

Mr. T. E. Colcutt, the architect, has adopted the Renaissance characteristics, and the general impression conveyed by the *ensemble* of the building is one of strength and permanence, relieved by ample mouldings in the gables and carvings of the balustrades.

Portland stone is the material chiefly employed in the structure, and as this comes from the Whitbed Quarry, it is hoped to long withstand deterioration in the London atmosphere. The great portal, flanked by lions and other statuary from Mr. Pegram's chisel, is ornamented with a frieze covered with symbolic sculptures, and with a seated figure of the Queen. At the side is the great foundation stone, brought from the Cape, of three tons weight.

Passing through the main entrance, a vestibule is reached, into which a polished stone corridor opens, running on either side to the end of the building. The vestibule gives access behind to the great reception hall, the finest part of the interior. Opening out of the corridor on the principal floor are spacious conference rooms for the American, Australasian, African, and Indian sections, the administrative offices, and temporary library and reading room. Ascending from the main entrance by a highly decorated marble staircase, we reach the first floor, which is devoted to conference rooms of the crown colonies, meeting rooms for societies connected with the institute, and the departments of commercial intelligence. The corresponding rooms on the floor above are chiefly intended for the sample examination stores and laboratories, a map department, and for the social use of the fellows of the institute. Parallel with the main building, in its rear, and separated by quadrangles, run two long galleries, the intermediate and the north, in which are stored, in individual sections, the exhibits of the various colonies. In many cases a nucleus has been acquired in stores handed over by the Colonial Commissioners from the Colonial Exhibition of 1886, the Indian section especially starting, through this means, with a considerable display.

In his letter to the Lord Mayor of London in 1886, the Prince of Wales sketched in outline the objects of this Jubilee memorial, the form of which is due to his own suggestion, and which has taken definite shape under his constant active supervision. It was to be "at once a museum, an exhibition, and the proper locality for the discussion of Colonial and Indian subjects."

The grants already guaranteed by several of the great colonies insure their active interest in the maintenance of their own sections.

In their own stately chambers in the front of the building, decorated with woodwork sent from the colonies themselves, the special conferences of the British American representatives, and of the British Australasian in the west wing, and those of the British African and the British Indian in the east wing, may be expected to decide issues of great commercial importance. The colonial importer and the manufacturer of the great industrial centers will find a common meeting place for the discussion of kindred interests, while opportunities will be afforded for the inspection in the galleries of samples of the products of every part of the empire. As an intelligence department serves to keep the War Office acquainted with the military resources and requirements of every land under the protection of the British flag, so a commercial intelligence department will have its headquarters in the institute, where systematic information upon the commercial development and the products of the various colonies may be obtained for the furtherance of British trade. The details of this system are being worked out with great elaboration. The arrangement of the Indian section is most advanced, and in the index museum it is already possible to compare various specimens of cotton fibers, rice, gum, and other raw products. Thus valuable help in no long time will be forthcoming from the institute in the improvement of commercial education by scientific organization. Another side of the institute's usefulness will be brought into prominence when its fellows enter upon their privileges. That these are sufficiently attractive may be gauged from the fact that more than a thousand candidates were elected at the last meeting of the executive council. The annual subscription entitles to free use of the reading and conference rooms and to admittance to the meetings held by the institute, while in the building itself rooms are set apart for their special comfort, much as in a club house.

A building so vast necessarily requires an immense amount of machinery for purposes of lighting, heating, and lifting. The machine room contains engines capable of supplying electricity for the 1,200 small lamps and 100 arc lights, and of driving hot or cold air through miles of piping. There are eleven lifts worked by hydraulic pressure obtained by pumping engines and power storage plant. The tanks for the water required in the building are placed in the three towers, of which the central will reach an altitude of 300 feet, while the flanking towers, only one of which has yet been completed, and which will have an exceedingly graceful appearance, will be 176 feet in height. The estimated cost of the building when fully completed is not far from $3,000,000.

The Ox Bot Fly.

In North America, so far as we yet know, *Hypoderma bovis* does not occur. Considering the frequency with which cattle have been imported into this country from abroad this fact seems almost incredible, yet until the species is observed and recorded we must consider its presence in America as merely conjectural. The American ox warble, in every case so far observed, is the larva of *Hypoderma lineata*. This species has come to be known, especially through the South and Southwest, as the heel fly, on account of the habit which the female has of frequenting the legs of animals for purposes of oviposition. While the eggs are laid on other parts of the body that may be reached by the tongue, the species shows quite a strong tendency to select the flanks and legs around the heels, and the habit, almost everywhere observed, that cattle have of seeking to protect their legs by running into water during the bot fly season finds its explanation in these facts. The eggs are attached firmly, by a strong cleft, in rows of from five to ten or more, to the hairs.

When the cattle lick themselves, the young larvæ are taken into the mouth, as, under pressure and moisture, the egg readily splits at its anterior end and releases the young larva, which is already well developed when the egg is laid. Doubtless quite frequently the eggs with the contained larvæ are taken with the hair in this licking, but in either event the larva in leaving the egg is armed with many minute spines, which permit it to adhere to and to penetrate the walls of the œsophagus. Here it soon moults and takes on the second or smooth stage, which for eight or nine months wanders slowly in the tissues of its host. The slow movement and the little nourishment taken reduce the inflammation and irritation to a minimum; in fact, the most remarkable thing in the life-history of this larva is the long period of latency and the slight development that takes place during the summer and autumn months. During the late winter the larva reaches a point beneath the skin in the region of the back and penetrates the skin, anal end first, as Dr. Curtice believes, and as seems most probable. Here it moults a second time and reassumes its spinous character, producing more or less inflammation and developing rapidly, with its enlarged spiracles fitted for more perfect breathing. The third moult soon follows, and we get the more strongly spined grub, with its still larger spiracles, which lives in the swellings or sacs so well known to stockmen. It finally works its way out, drops to the ground, which it enters, and where it contracts, hardens, and darkens in color. In a few weeks afterward the perfect fly issues.

That such is the normal and invariable life-history of *Hypoderma lineata* I think there can no longer be a doubt, and the burden of proof of any departure from it will rest hereafter with those who contend otherwise. That the remarkable life-history of such a well known insect, and one which does so much injury to our cattle interests, should have remained so many years unknown, is only another illustration of the fact that we have yet much to learn of our commonest species.

That this life-history of *Hypoderma lineata* will be fruitful in bringing to light the actual facts in reference to the European *Hypoderma bovis* there can be little doubt. The unity of habit in the same genus, the structure of the egg, as already known, of *Hypoderma bovis*, and the fact that nothing definite is yet known of the earlier larval stages or the mode of oviposition, all convince me that this species will be found in Europe to have a precisely similar life-history.—*C. V. Riley, in Insect Life.*

The Busk-Ivanhoe Tunnel.

On June 30 last there remained 1,084 ft. of tunnel to be bored to complete the Busk-Ivanhoe Tunnel, on the line of the Colorado Midland Railroad. M. H. Keefe, the contractor for building the tuunel, estimates that the headings will meet in four months' time. The total length of the tunnel is 9,400 ft. The boring from the Ivanhoe end of the tunnel has been temporarily suspended because of the trouble in keeping the tunnel at that end free of water, the pumping plant erected for that purpose having proved inadequate. The grade of the tunnel descends uniformly from the Ivanhoe to the Busk end, the latter being 134 ft. lower than the Ivanhoe end; as a consequence water follows the workings of the tunnel into the hill at the Ivanhoe end, and to keep the tunnel free of water the contractor erected two Cameron pumps, one with a 8 in. discharge, capable of handling 100 gallons of water a minute, and one with a 4 in. discharge, capable of handliug 300 gallons of water a minute; and also a Deane duplex pump, capable of handling 400 gallons a minute.

Correspondence.

Forging Coppers.

To the Editor of the Scientific American:

In your issue of July 15, 1893, H. K. gives his experience casting solder coppers and then trying to forge them and failing. I made a solder copper in the following manner:

I had no copper but some scraps of sheet copper used in making steam pipes. I suppose it was pure. I closed and welded one end of a 1½ inch pipe (short piece), melted my copper in a crucible in the forge, warmed the piece of pipe, and set it closed end down in one of the holes in my swage block. Had my copper good and hot, in order that it should be limpid and pour free. I stood well back while pouring it, for fear it should "blow," but it didn't. When it was cold, I split the pipe and took the copper in my tongs, heated, and forged it nicely. I used no alloy or flux. The top end, as cast, was somewhat porous or "bubbly;" but this only affected it for a half inch or so.

W. H. WOODRUFF.

Willapa, Wash., July 19, 1893.

Velocity of Projectiles.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN for July 1, 1893, on page 7, appears a "Simple Method of Determining the Velocity of Projectiles." As I understand it, it is entirely wrong and is worthless for the purpose intended. Gravity pulls the projectile down, whether the sights are above or below the bore of the rifle. If the line of sight is exactly parallel with the axis of the bore, then the shot will strike at a certain distance below the bull's eye, whether the sights are above or below the bore. In this case, "half the difference in the elevation of the two bullet marks" will be zero, and hence the effect of gravity in drawing the bullet down is nothing. Absurd! The difference between the bullet marks can only be caused by an angle between the line of sight and the axis of the bore. Gravity has nothing to do with the difference. F. R. BRAINARD,

Lieut. U. S. Navy.

U. S. S. Kearsarge, Portsmouth, N. H., July 28, 1893.

Sperrylite.

To the Editor of the Scientific American:

In the letter of your Chicago correspondent published on page 26 of your issue of July 8, 1893, the statement is made, relative to sperrylite, that "it is a yellow, dust-like powder, found in pockets, and assays fifteen ounces to a ton of platinum."

While this statement is rather equivocal in its meaning, it is also an erroneous one, in so far as its description of the mineral in question goes. In the last edition of his "Mineralogy," Prof. Dana describes the species as occurring in minute crystals, usually in cubes or cubo-octahedrons, etc. Fracture conchoidal. Luster metallic, brilliant. Color, *tin-white*. The specimens usually seen in collections agree closely with this description. Neither is it a fine powder. It occurs in small grains.

As this is one of the most interesting minerals recently described, I thought the mistake of sufficient importance to call your attention to.

GEORGE VAUX, JR.

Bryn Mawr, Pa., July 28, 1893.

Preserving Butter with CO_2.

It is some time since the solidification of carbon dioxide has been effected, and in such a manner as to render the article of considerable commercial value, and readily adapted to a multitude of useful purposes. Two fresh instances, says *Le Génie Civil*, have recently presented themselves of the extensive sphere opened to the application of the frozen gas. By its aid, butter can be preserved, without in the least interfering with its taste or general properties. The process of preservation consists in placing the butter in an iron vessel, or it can provided with a pipe and tap, by means of which the carbonic acid is injected under a pressure of six atmospheres, and drives out the air. In this condition the butter will remain fresh for four or five weeks. The second instance is one in which the carbonic acid is forced into whey to the point of saturation, and converts that liquid into a refreshing and agreeable beverage which "fizzes" like champagne. The carbonated whey can be inclosed in siphons like ordinary mineral waters, and will remain fit for use for the next six weeks.

Tests with Emmensite.

The ordnance officers are making some interesting tests of high explosives at Sandy Hook. Shells filled with gun cotton and with emmensite were fired recently from the 12-inch mortars. The object of the test was to see if emmensite could be fired without danger of explosion of the gun or mortar. The emmensite shell carried 87 pounds of the explosive. The tests were successful, and when a proper fuse has been secured the army and navy will have an explosive even more efficient than the melinite of the French artillery.

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WORLD'S FAIR NOTES.

(*Continued from page 115.*)

The landscape gardening in the Exposition grounds is very grand. The park stretches along the southern shore of Lake Michigan and for about a mile there is a graceful curve with a low sloping beach upon which the waves splash, usually with the gentleness of a land-locked arm of the sea, but during a storm with a vigor that approaches that of the ocean itself. A broad promenade follows along the edge of the beach, giving a beautiful view of the lake and the many buildings that face it. Two canals extend from the lake into the center of the Exposition grounds, giving outlets to the waterways called the lagoons and the Basin with their connecting canal. These waterways, especially the lagoons, are superb. I am told these are not natural, but that they were dredged out and the earth taken from them used to raise the foundations of the Exposition buildings above the line of the swamp of which this park consisted before the Exposition was located here. The banks of the lagoons are lined with foliage, all aquatic shrubs indigenous to northern Illinois being transplanted.

In the center of the lagoons is what is called the Wooded Island. This is the garden spot of the grounds. It comprises about ten acres and is laid out with winding paths. Nearly all of its area is given over to the exhibits of flowers and flowering shrubs and foliage plants. The Basin is a body of water of considerable size walled in on all sides by walls of staff resembling marble, and surrounded by the noblest of the Exposition buildings. In fact, the region about this Basin is called the Court of Honor; here the illuminating in the evening is done, and in this vicinity are located the grandest works of sculpture and architecture.

The collection of old watches in the Swiss section of the Manufactures building is very curious, as it shows the gradual advancement of the science and art of horology from the clumsy affairs of former centuries to the matchless timepieces of to-day. The oldest watch on exhibition bears the date 1074 of the Hegira, the watch being of Arabian workmanship. The watch has a hammered bronze case, which covers works of oriental simplicity. The hand marked the hours on a dial inscribed with Arabian numerals. A "Nuremberg egg," dated 1550, is shown, as well as a watch which dates from the time of the French revolution. The dial divides the day into ten hours and each hour into 100 minutes, according to a decree of the National Convention, which ordered that the decimal system be used for all measures. Some watches are shown which were made by the great-grandfather of Jean Jacques Rousseau. A wooden watch made by a Siberian convict attracts many visitors. The workmanship was so marvelous that such a workman could not be lost to art, and he was pardoned. Some of the modern watches are wonderful. Watches for rings, bracelets, etc., are shown mounted and unmounted. A spring in the back of a small beetle opens, displaying a tiny watch.

The lighting of the Ferris Wheel is effected by means of 1,400 electrical lamps.

A model of St. Peter's, at Rome, is exhibited near the Ferris Wheel, in the Midway Plaisance, by L. De B. Spindor. The model is 30 feet long, 15 feet wide, and about 15 feet high. Two men in front of the building, dressed in the orthodox uniforms of the Swiss guards of the Vatican, bid for custom with trombones. The model is made of wood, and is covered with a kind of varnish or stucco, which imitates stone. Various other models are included in the exhibit, as the Milan Cathedral, St. Agnes' Church, at Rome, the Piombino Palace, etc.

A gigantic flagstone is exhibited from Colorado. The stone is 25 feet long, 8 feet wide, and 10 inches thick.

A writer in the *Century Magazine* gives the following advice to visitors: Take a day first to satisfy your curiosity, to gratify your sense of wonderment and your love of beauty, to get your bearings and discover how much exertion you can support. Go all over the Fair grounds, and to the top of at least one of the big domes or towers. See the Fair, as a Fair, from its various centers and from different parts of its circumference, especially from the lake. I think you can do this in one or two days, if you start early and end late, if you are strong, and if you have yourself conveyed by all the available means of conveyance—encircling railways, boats, and rolling chairs—and if you do not step inside a single building except for the ascent in search of your bird's eye view. Then go home, stay in bed the following day, if you are wise, and the next day spread the wings and stiffen the spine of your conscience, and go in search of the things you have come to study—steam boilers or roses, fishes or stuffed birds, needle work or statistics of idiot asylums, methods of slaughtering men or cattle, or of preserving human life or edible fruits. Stay at this task until you have finished it, or until it has exhausted your powers of application. Then release and relax yourself. Go to see something else—palms if you have been studying plows, pictures if you have been studying electric motors.

THE WORLD'S COLUMBIAN EXPOSITION—A VIEW IN COLUMBIAN AVENUE, PALACE OF MANUFACTURES AND LIBERAL ARTS.

The Manufactures building is at once the wonder and the glory of the Fair. This huge structure, which is rectangular in form, measuring 1,687 by 787 feet, was designed by Mr. Geo. B. Post, of New York, and the great fabric abundantly testifies to Mr. Post's ability as an engineer as well as an architect. The Manufactures building is said to be the largest roofed building ever constructed, and some idea of its magnitude may be obtained when it is stated that the total floor space of both the main floor and gallery is forty-four acres. The Palace of Mechanic Arts at the Paris Exposition of 1889 could be placed inside the Manufactures building without touching any portion of the walls or roof, even with the Eiffel Tower laid flat on top. Seventeen million feet of lumber entered into the construction of the building, as well as 12,000,000 pounds of steel and five car loads of nails. The amount of staff used on the exterior could not be easily calculated. The total cost was $1,700,000, and this cost would be entirely paid up if the building could be filled with an audience at $5.65 a head, for the building would seat 300,000 people or three and three quarter times the seating capacity of the coliseum at Rome.

The exterior of the building is plain, which adds to its effect of grandeur. Decoration is entirely subservient to construction, and decoration is shown chiefly in the eight entrances, over each of which is a small dome, decorated by a celebrated American artist. All effects of color are obtained by flags and pennants on the roof. Crossing the bridge by the Electricity building, the main entrance is reached. There is really no difference in the entrances, but the one through which the greatest number of people enter the building, is called the main entrance. Passing under the beautifully decorated dome, the visitor enters the great building and in a moment stands in Columbian Avenue, the main thoroughfare through the building. Standing at the south entrance and looking north the effect is grand. On each side rise the exhibits of foreign nations, which in many cases come from thousands and even tens of thousands of miles. In the distance the clock tower breaks the seemingly endless vista. Overhead the huge trusses show the skeleton which forms the backbone of the building. Suspended from the roof are great coronas of arc lights, which alternate with huge flags.

At the left of our illustration will be seen the pavilion of a sister republic—Switzerland. The collection of watches in the Swiss section is very wonderful, and some of the tiny examples of the horologists' art seem almost too small to keep time. Directly beyond the Swiss pavilion rises the lofty tower of the Danish section. The exhibit of Denmark, and in fact all of the northern countries, is very creditable. A narrow aisle separates Denmark from Canada and Great Britain. Just beyond the clock tower will be noticed the obelisks surmounting the pavilion of Austria. At the right of the cut, near the bottom, is the section of Norway, which is admirably filled with the products of the land of the midnight sun.

Beyond the Norwegian section is the carved wood pavilion of Russia, which contains marvelous works executed in silver, malachite, rhodonite, and lapis lazuli. This section was opened by a mitered bishop of the Greek Church, with all the pomp and ceremony of the Greek ritual. The Belgium pavilion is beyond the Russian section, and beyond this again is the very ornate façade of the French section. The entrance to the French section is very imposing, and is justly admired. The column with the ball on the top, just beyond the clock tower, is the beginning of the United States section, the column being directly above the exhibit of Messrs. Tiffany.

Queen of the Evening Sky.

Venus, after an absence of nearly a year, has again made her appearance as an evening star, and may now be seen for a short time in the early evening in the west. She will continue to adorn the western skies during the remainder of the year, growing brighter and brighter, and not reaching her greatest brilliancy until the 6th of January next.

As Vesper, the evening star *par excellence*, this brilliant planet, which Homer, ages ago, apostrophized in words indorsed by all succeeding generations as "the most beautiful star that stands in the heavens," is always a welcome visitor and an object of keen interest for every one whose eyes are open to the beauties of the starry firmament. As a "naked eye" object, it stands without a rival. Even Jupiter, the giant of the solar system, and Sirius, the giant among the fixed stars, pale before Venus when at her brightest.

One would suppose that Venus would form a spendid object for a telescope. On the contrary, it is one of the most difficult objects in the heavens to see satisfactorily with this instrument. Its dazzling light brings out all the defects of a telescope, and, being low in the heavens after dark, it is always more or less tremulous. The best telescopic views of Venus are obtained in broad daylight, when it is high above the horizon. All astronomical studies of it are made at that time. Thus viewed, with its strong light subdued by the glare of the day and posed upon a background of blue sky, it is indeed a beautiful object, resembling the moon seen under the same conditions, but free from the dark blotches that disfigure that luminary.

Venus has no markings distinguishable with a small telescope. It is interesting mainly for its changing phases. Being an "inferior" planet, and passing at times between us and the sun, it goes through the same changes of aspect as are familiar in the monthly changes of the moon, with the important difference that, being when "full" nearly seven times as far away as when in its most slender crescent phase, it undergoes a corresponding change in apparent size.

As it appears now, having but just emerged from behind the sun, it is nearly full. On December 6 it will be at its greatest apparent distance from the sun, and on January 6 it will have attained its greatest brilliancy. After this last date it will draw rapidly toward the sun, and its crescent will grow more and more slender until it becomes invisible, except through the largest telescopes.—*Phila. Record.*

An Invention Wanted.

United States Consul Edward Bedloe, writing from Amoy, China, to the State Department, says:

A fortune lies in store for the man who will discover some process for cheaply making wood proof against white ants. These pests are the curse of existence in Amoy and every other tropical or sub-tropical city. Their voracity is incredible. They ate the framework of a new door in this consulate in three weeks. In the same period they almost consumed a large and handsome cabinet in the court room and a heavy pine settee in the anteroom. Their work is invisible. They attack the wood from a mere point, through which they bore to the interior and there eat everything until only a shell or film remains. Wood which will successfully resist these insect pests must be thoroughly charged with some powerful chemical, both poisonous and non-evaporable. A solution of corrosive sublimate, chloride of zinc, arsenic, or antimony would seem to meet the want. But how to force these into the fibers until the latter are saturated, and to do so at a merely fractional cost of the wood itself, is the problem that confronts the inventor. The American genius is so prolific in invention and discovery that I feel assured the problem will be satisfactorily solved.

The Comet through Lick Lens.

Director Holden, of the Lick Observatory, has presented the San Francisco *Examiner* with an exact reproduction of a photograph made with the Lick telescope by Professor W. J. Hussey, of the comet now attracting attention in the northwestern sky. The plate was exposed from 9:10 to 10:20 on the evening of Thursday, July 13. The picture is intensely interesting.

It shows, says the journal mentioned, "what was doubtless the earliest apparition of the 'secondary' comet. In the tail of the great comet is to be plainly discerned the nucleus of an 'auxiliary' comet forming, just as the Holmes comet was seen to divide into separate components when Barnard photographed that very interesting object last November. Usually comets have been supposed to divide at the nucleus through some force not thoroughly understood, as in the case of the celebrated comet of Biela, or again when Sawerthal's comet of 1888 exhibited no less than three distinct nuclei. But with the Holmes comet, and that now under observation, the separation seems to be effected in the tail of the comet. It would certainly seem, from these photographs, that the tail of the comet must be composed of solid particles, else how could a secondary comet be formed from it?"

There is no record in all astronomical history of one comet within the tail of another. As yet there is not enough of data obtained to determine whether the comets have the same or different rates of speed, or whether they are near to or remote from each other. It may be that the "secondary" was formed out of the brighter comet, either through some internal disruptive action, or as the result of the more or less intimate contact with some other celestial vagrant like itself. Of course, comets have been known to dissolve. Some also have been observed to break up; but the parts have never been seen to present the like apparent relative positions as in the present instance. Theories to account for the phenomenon may be imagined in any number; but there are not enough of well-ascertained facts to sustain a single plausible one of them.

Large Guns for the Navy.

The experience of Great Britain and Italy has not tended to predispose our authorities in favor of exceptionally heavy ordnance. The 110 ton guns have been removed from Italian ships. The war vessels Indiana, Massachusetts, and Oregon are each to be supplied with four 13 inch pieces. They are nearly 40 feet in length. The diameter at the breech is somewhat over 4 feet and at the muzzle 21 inches. These guns throw a projectile of 1,100 pounds, with 550 pounds of powder as a charge.

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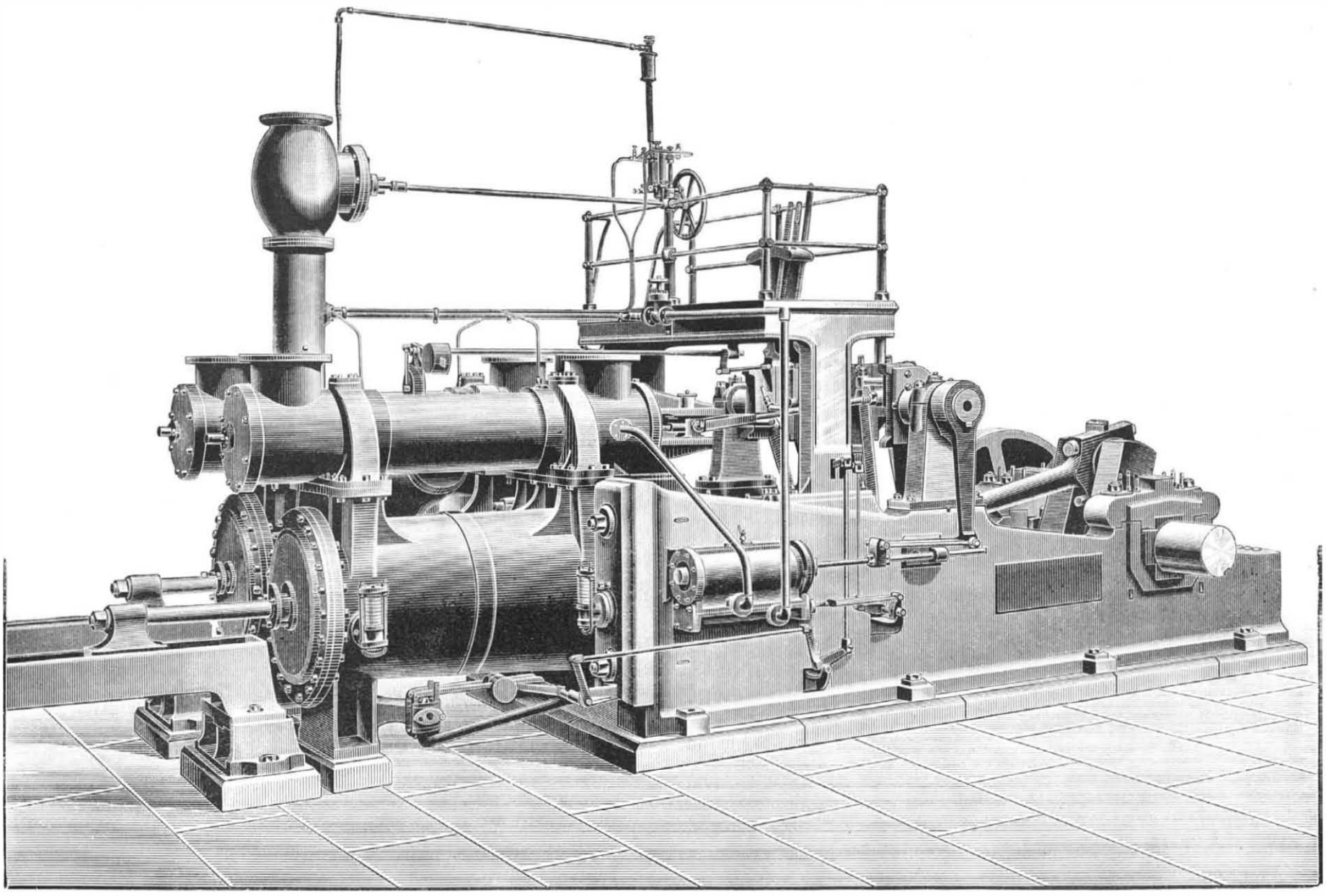
An Anti-Smoke Law.

The legislature of Massachusetts, at its last session, enacted the following law relating to the prevention of smoke:

"In cities of over 300,000 inhabitants, no person shall, after the first day of July, in the year 1893, use bituminous coal for the purpose of making steam in boilers in any building, unless th furnace in which said coal is burned is so built, managed, arranged, or equipped that at least 75 per ent of th moke from said coal is consumed or oth rwise prevented from entering the atmosphere, the degree of suppression being determined by the quantity of such smoke emitted, as shown by the density and color of the issuing smoke, and the length of time which it is visible, the maximum standard of comparison being a continuous discharge of dense, dark smoke during the time the furnace is in active operation."

MILL ENGINES.

The illustration represents a pair of high-pressure non-condensing reversing mill engines, as constructed by Galloways, Limited, Manchester, for Messrs. Leach, Flower & Co., of the Melyn Tin Plate Works, Briton Ferry, and shown in the *Engineer*. These engines



ROLLING MILL ENGINES, MELYN TIN PLATE WORKS.

embody the results of the very large experience which the makers have had in supplying machinery for the tin plate trade and rolling mill purposes generally. The engines in question have cylinders 40 in. bore and 4 ft. 6 in. stroke, the main shaft has a single-sweep crank for one cylinder, the other cylinder being connected to a crank pin secured in a disk at the end of the shaft, this disk being arranged to balance the connecting rods of both engines, as well as the sweep crank, so constituting a very simple and efficient form of connection to the mill. The valve gear, as will be seen, is on Joy's system, which lends itself admirably to the type of engine here illustrated. The platform is so arranged that the man handling the engine looks direct to the rolls, and has under his immediate control the reversing gear, steam stop valve, regulating valve, waste water valves, and the lubrication of the steam cylinders.

Natural Water Pipes.

A curious phenomenon has been discovered near Eddy, New Mexico. In Dark Canyon, about three miles from Eddy, a number of tunnels were run in order to tap streams of water to get a supply for the waterworks. The water was found running in small natural pipes, made by the deposit of lime from the water. The whole space cut by the tunnels was found to be perforated with these lime pipes.

Volatility of Metals.

Interesting experiments with the electric furnace are, says *Nature*, described by M. Moissan in the current number of the *Comptes Rendus*. By attaching to the furnace a condensing tube of copper shaped like the letter U, and so constructed as to be surrounded by an outer jacket of cold water constantly changing under high pressure, M. Moissan has been enabed to distill and condense most of the elements which have hitherto been found so refractory. When a piece of metallic copper, weighing over a hundred grammes, was placed in the inner crucible of the furnace and subjected to the arc furnished by a current of 350 amperes, brilliant flames shot forth from the apertures through which the carbon terminals were inserted. The flames were accompanied by copious yellow fumes, due to the combustion of the issuing vapor of copper in contact with the oxygen of the air. After the expiration of five minutes nearly thirty grammes of copper had been volatilized. Under the cover of the furnace an annular deposit of globules of metallic copper was found, and upon examination of the condensing tube a large proportion of the volatilized copper was discovered condensed in almost a pure state.

It has long been known that silver is volatile; it is now found that at the temperature of an arc of the above description silver may be brought to full ebullition in a few moments, and it distills with ease, condensing in the copper condenser in the form of globules, whose size varies from that of small shot to spherules of microscopic dimensions, and a certain proportion is usually deposited in the form of arborescent fragments. Platinum fuses in a few minutes, and very soon after commences to volatilize, and condenses in the U-tube in brilliant little spheres and fine dust. Aluminum distills very readily, and condenses in the form of a gray powder, containing admixed spherules exhibiting brilliant metallic luster. Tin likewise distills with facility, and the condnesed product usually contains a considerable proportion of a curious fibrous variety of the metal. The distillation of gold in the electric furnace is particularly interesting. Abundant fumes of a light yellowish-green color are emitted at the electrode apertures, and the metal is deposited in the condenser in the form a powder, exhibiting a beautiful purple sheen. The powder consists of minute regular spheres, which, when examined under the microscope, appear to reflect the usual yellow color of gold. Upon the under side of the cover of the furnace three distinct annular deposits are observed, the inner one consisting of yellow globules of considerable size, round which is a metallic deposit of smaller spheres of such a size as to reflect a bright red tint, and outside this is an annular sublimate of a deep purple color. Manganese is remarkably volatile. A quantity of the metal weighing four hundred grammes entirely volatilizes in ten minutes. Iron is likewise readily distilled, and is deposited in the form of a gray powder, among which are interspersed numerous small particles exhibiting brilliant surfaces.

Not only are the metals capable of distillation at the temperature of the electric arc. Silicon rapidly volatilizes and condenses in the copper condensing tube in minute spheres and dust. Carbon becomes almost immediately converted to graphite, which distills over into the condenser and deposits in the form of light semi-transparent plates, which hy transmitted light exhibit a beautiful chestnut color. Distilled carbon would thus appear to consist of the fourth variety of the element recently described by M. Berthelot. The refractory alkaline earths, appear also to be capable of distillation in the electric furnace. The experiment succeeds best, however, with a more powerful arc. Employing an arc furnished by a current of a thousand amperes, M. Moissan has distilled one hundred grammes of lime in five minutes, the vapor condensing in the copper tube like fine flour. Magnesia passes over somewhat more slowly than lime, but its distillation is one of the prettiest of these remarkable experiments, the tints assumed by the escaping fumes and the brilliance of the incandescent vapor being particularly striking.

Illustrations of the electric furnace and other interesting particulars will be found in the SCIENTIFIC AMERICAN for May 13, 1893, and in our SUPPLEMENT, Nos. 896, 901, 904, 905.

A Locust Year.

The Department of Agriculture has sent out circulars making inquiries over a wide extent of territory regarding the "seventeen-year locusts," which have made an appearance this year in eight States of the Union. The object of the department is to ascertain accurately the limits of the areas occupied by the insects. There are twenty-two known broods of them, and they turn up in different years in various parts of the country. Though to some extent the infested territories overlap, each brood comes out of the ground only once in seventeen years. Strictly speaking, the insects are not locusts, but cicadæ. Some years ago it was sought to introduce these insects as an article of diet; but the experiments in that direction did not promise success. Clearing of land has done much to diminish the number of these creatures; but their most destructive foe is the English sparrow, which drops every other kind of food and feeds on them exclusively when it has the opportunity.

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HOO-DEN, OR JAPANESE BUILDING.

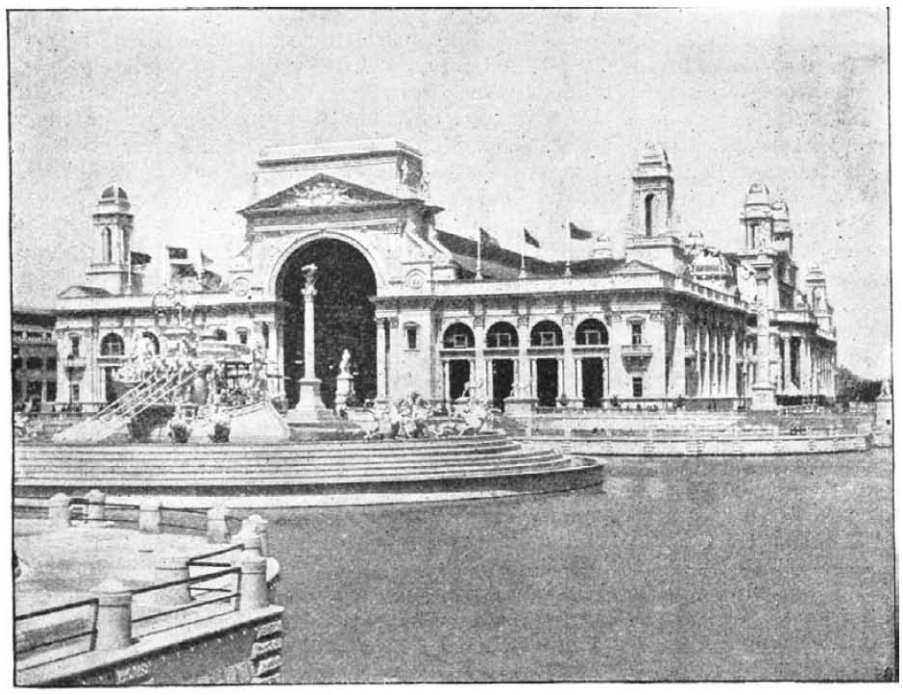
The Hoo-den, or Japanese building, on the Wooded Island is a very attractive building. The building is in three sections, the center one being a *fac-simile* of a room in the Nijo Castle, Kioto, built by Tokugawa Iyeyasu in 1601. No expense has been spared in the execution of these buildings and in the selection of their choice contents. Though the buildings are small still they are without doubt among the most expensive of the foreign buildings on the grounds. The entire series of buildings is presented to Chicago by his Highness the Emperor of Japan.

SOUTH SEA ISLAND VILLAGE.

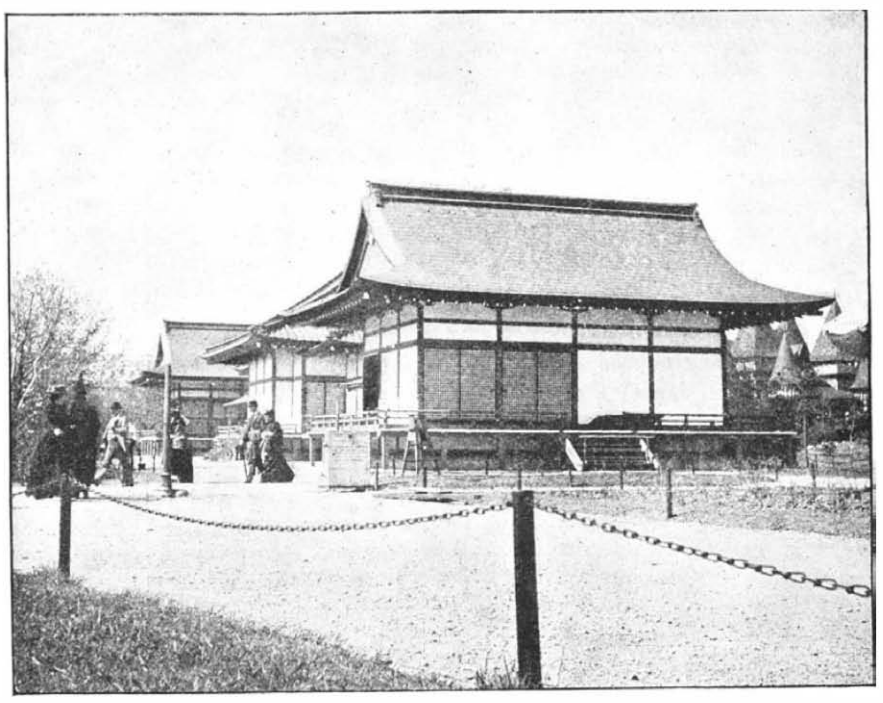
The South Sea Islanders have an exhibit in the Midway Plaisance consisting of four Samoan houses constructed by natives. The largest of the houses stood for ten years in the village of King Mataafa and is made from the wood of the bread-fruit treethatched by leaves of the wild sugar cane. There are about twenty-five villagers, natives of Samoa, Fiji Islands, etc.

Aluminum Solder.

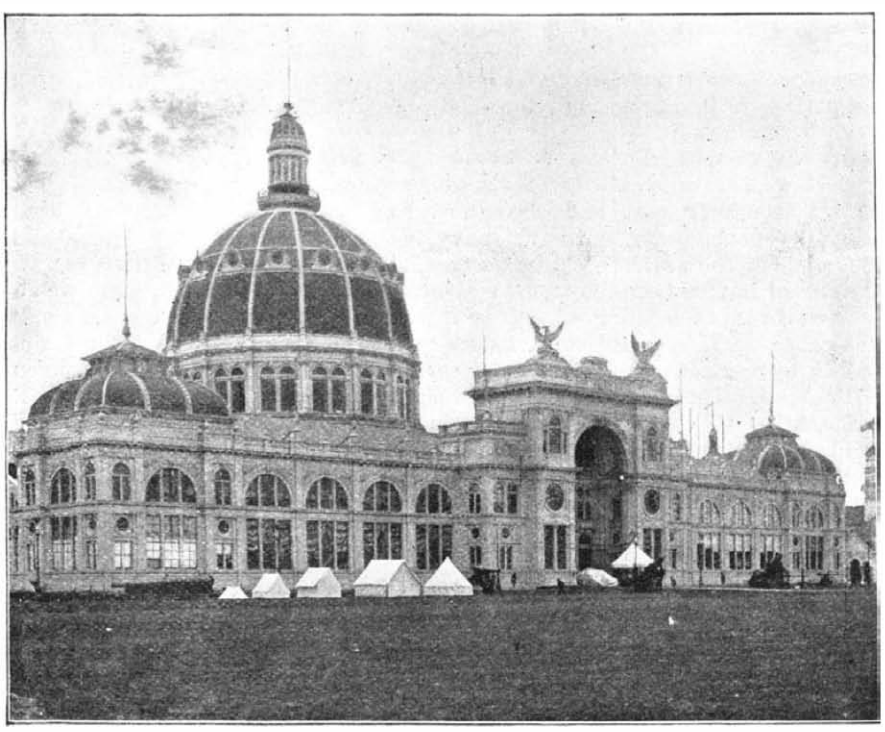
This is an alloy consisting of 9 parts of aluminum, 1 to 3 (or even 4) of silver, and 2 to 4 (or even 5) of copper. A silver-copper-zinc-aluminum alloy and a silver-brass-aluminum alloy are also described; moreover, the zinc may be replaced by cadmium or bismuth or a fusible alloy, such as "Wood's metal." A small proportion of gold may also be added. In making the alloys, the copper and silver are first melted together, molten aluminum added, and solid zinc then dropped in. To use the alloy it is broken up and spread between the surfaces of the articles to be soldered, previously heated. These are then pressed together with the soldering iron. No flux is required.



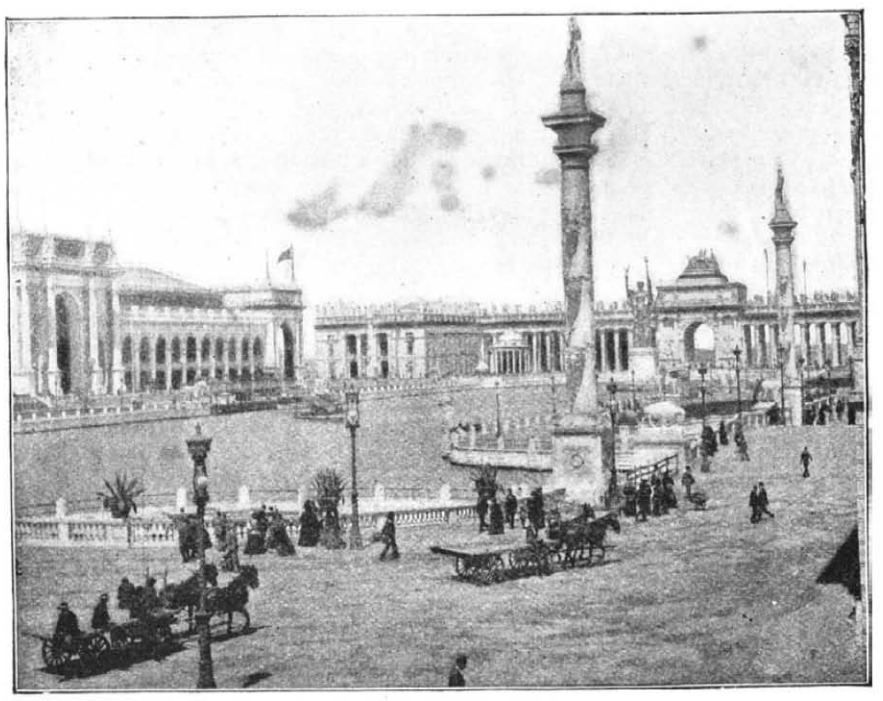
THE PALACE OF ELECTRICITY.



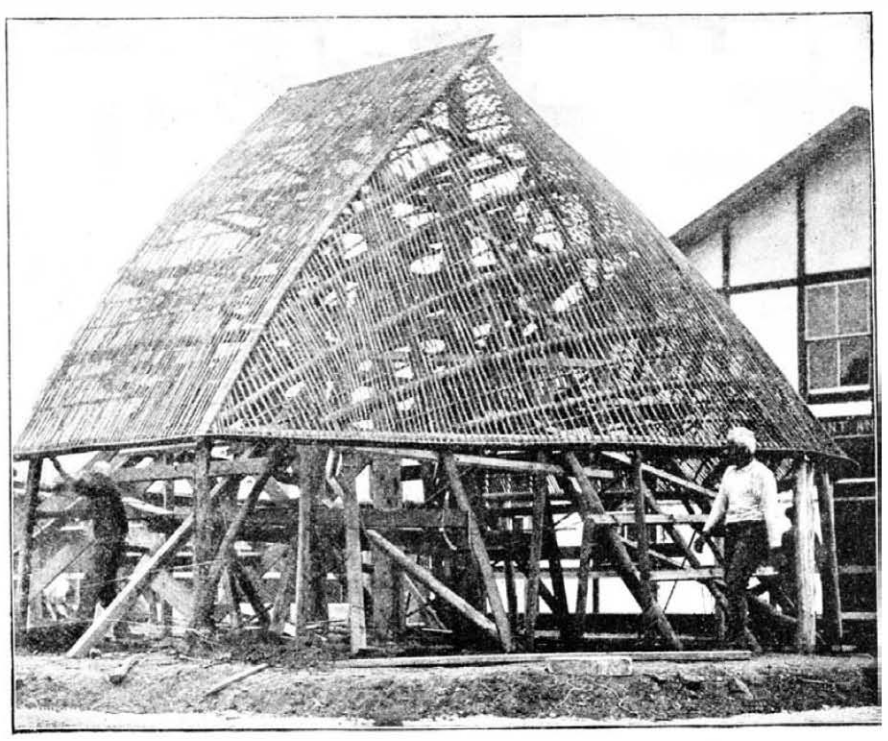
JAPANESE HOO-DEN—WOODED ISLAND.



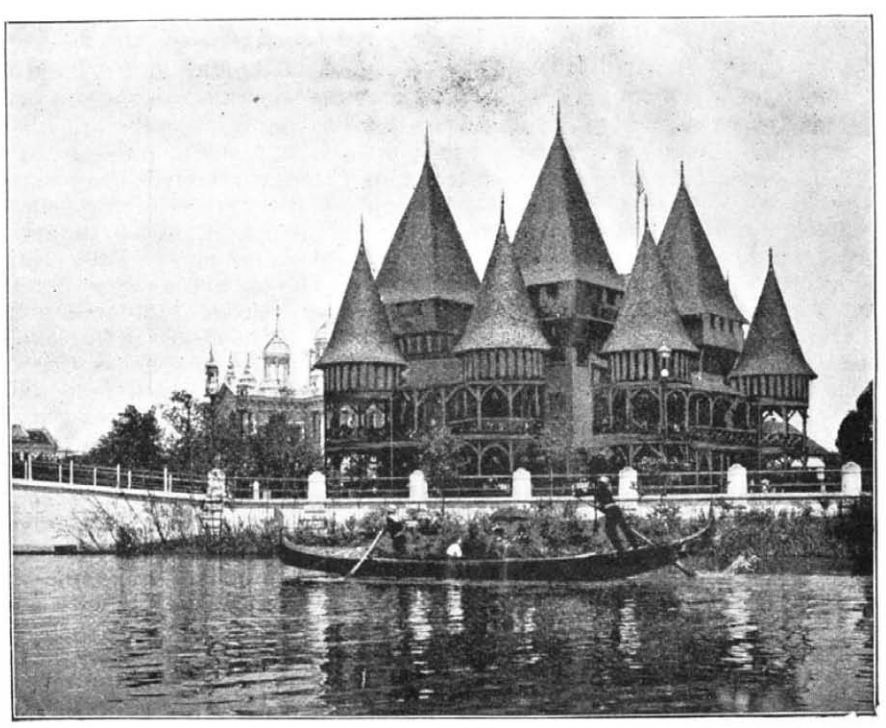
THE GOVERNMENT BUILDING.



VIEW ON THE LAGOON LOOKING NORTH—PALACE OF MANUFACTURES ON THE LEFT.



SOUTH SEA ISLAND HUT.



THE MARINE CASINO.

THE WORLD'S COLUMBIAN EXPOSITION—SOME NOTABLE BUILDINGS.

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Some Extinct Lakes.

RALPH S. TARR.

The investigations of members of the United States Geological Survey have revealed to us many interesting episodes in the geological history of the country, and have thrown much light on the physical geography of the past. Two of these events in particular are of interest, for the reason that they tell of most interesting changes, not only of geography but of climate. I refer to the former existence of great lakes, one in the vicinity of Great Salt Lake, the other in the valley of the Red River of the North.

It was very early known (indeed, the early settlers could see it) that there had at one time been a great lake on the site of the present salt lake and desert in Utah. The early explorers noted the presence of terraces, flat-topped and often of remarkably uniform height, which they knew to be water-formed. There were bars, also, across the mouths of side streams, and spits, wave-cut cliffs at headlands, and, indeed, all the phenomena of lake shores along these terraces. Not only is there one terrace, but several which mark changes in the level of the lake.

Mr. G. K. Gilbert, of the United States Survey, undertook the task of unraveling the history of this region as shown by the terraces and gravels, and has published a most fascinating account of his results as a monograph of the United States Geological Survey, bearing the title of "Lake Bonneville," the name given to the extinct lake. What I have to say in this part of the article is merely a summary of his book, which every one interested in the subject should read.

Every tourist to Salt Lake City must have noticed the flat benches clinging to the mountain sides and have marked the flat desert tract in which the Great Salt Lake is situated, and, perhaps, have wondered what it means. They may have noticed the small mountain peaks rising from the desert like islands in the sea. These were once islands, and now they rise out of the lake sediments in which they are partly buried.

The mountain streams flow out upon the plain and disappear in the gravel. Here and there a shallow pool of saline water stretches over a depressed part of the plain, where some unusual rains give to the streams an excessive supply of water; but these soon evaporate and leave a dry mud, flat or marsh, perhaps glistening with salt or alkali. The term playa has been given to these patches, and when they are transformed to a lake they become playa lakes. When the mountain streams are continuous and their current sufficient, the waters accumulate and remain throughout the year. But there is no escape for the water except through evaporation, and as evaporation takes only the pure water, and as all water carries salt and other substances in solution, obtained as it passes over the rocks, this is left behind, and each year the undrained lake becomes salter.

This is the present condition, and for many years the region has been in essentially this same condition; but a study of the terraces shows that at one time this great basin was filled with water and overflowed by way of Red Rock Pass into Marsh Creek and thence into the Columbia. This is shown not only by the high terraces, but also by the outlet itself. At present this outlet is a divide occupied by small vacillating streams and dry channel-ways, and by the crumbling of its steep walls it is being clogged. That it was once occupied by a mighty torrent might almost have been determined without the additional evidence of the associated shore lines. It has been cut to a depth of several hundred feet, with a width of a third of a mile.

When Lake Bonneville was full of water to overflowing, it had a surface of 19,750 square miles—a magnitude ranking it with the Great Lakes. Its maximum depth was 1,050 feet. Of it Mr. Gilbert says: "If the water were to rise again to its old mark, more than one hundred towns and villages would be submerged and 130,000 persons would be driven from their homes. The Mormon temple would stand in 850 feet of water," and 700 miles of railroad would be immersed.

The history of the lake is even more complicated than has been indicated. There is evidence that long before the existence of the overflowing lake the site was practically dry and arid. The water afterward rose, but not to its rim, and then another change in climate occurred and aridity again set in and the lake basin became nearly if not quite dry. A second rise occurred, and this time the lake overflowed to the ocean. Since that time the climate has been growing progressively more arid, and the author predicts that this may possibly continue until even the last remnant of the salt lake is evaporated. The evidence of these changes is conclusive, and will not be given here, but can be found in the monograph.

As to the duration of these periods, little can be said that is definite. The first period of aridity was probably much longer than any subsequent one, and the first rise of water appears to have lasted nearly five times as long as the second. The intervening dry period appears to have been of greater duration than the present period of aridity. There are no data at hand for an estimate of this period in years; but if, as seems probable, they were associated in point of time with the advances and retreats of the ice in glacial times, each episode must be represented in thousands, perhaps tens of thousands of years. On evidence, more or less reliable, it has been estimated that the close of the last glacial epoch was not far from 10,000 years ago, and it seems probable that at this time the last period of desiccation set in. We, therefore, have a rough basis for a calculation in years.

Just why these climatic changes have taken place no one can say with definiteness, although there is no lack of theory to account for it. The presence of a body of ice on northern America would amply account for an increase of precipitation; but here the difficulty is not lessened, for we must account for the ice. Some suppose that the land was higher in the north, and hence colder. Others suppose that astronomical causes must be sought for; and still others that a change in ocean currents accounts for the climatic variations. Many think that the real explanation is a combination of two or more of these causes. This much we know, that the present arid condition of the region is the result of the dryness of the air, which has been robbed of its moisture as it passes from the sea over the land and over the high mountains; but why this was not formerly the case, we cannot adequately explain.

Other interesting phenomena are revealed by this study. Before, during, and since the period of high water, the great basin has been the seat of considerable volcanic activity. At times the lava has flowed on the margin of the lake, again it has entered the waters, and volcanic eruptions have occurred even in the lake itself. At present, all volcanic activity seems to have ceased, though some of the lava has been erupted in very recent times.

Not only has the level of the water changed, but even the level of the land has suffered a change since the water sank below the terrace levels. Lake beaches are, of course, all formed in a horizontal position, and normally they should be at the same level in every part. But some of the terraces of Lake Bonneville are disturbed by faulting and folding, and are no longer level. These changes may possibly be associated with the volcanic eruptions.

It is not improbable that there are secular variations of climate, extending over great periods of time and changing so slowly as to have escaped our attention—great curves of variation, first of dryness, then of aridity, dependent upon some cause which we have not yet discovered. There even seems some reason to suppose that the world is at present in a condition of aridity. Arid basins are common in various parts of the world, and many of them seem to show signs of having been at one time occupied by water, as was the great basin of the West. There are many instances of this, and the ancestor of the Great Salt Lake is by no means the only one in the plateau region of the West. There are many such lake beds in New Mexico, Arizona, Nevada, and also in other parts of the world; but of foreign examples we know little, for their history has never been studied in detail.

LAKE AGASSIZ.

The second instance of a great lake, now extinct—that of the valley of the Red River of the North—is also associated in origin with the glacial invasion, and it has been appropriately named Lake Agassiz, in honor of the one who first proved that the northern part of the continent had been occupied by an ice sheet. This has been studied in much detail and reported upon admirably by Mr. Warren Upham in reports of the Minnesota State Geological Survey and in the publication of the Canadian Geological Survey. He is also preparing a monograph upon the subject for the United States Survey.

Here, as in Utah, the lake beaches, bars, terraces, and cliffs mark the history of the lake, and the broad, flat plains of the Red River Valley record the presence of a sheet of water. At present the Red River flows north through the plain; but when Lake Agassiz existed it was forced to flow southward, into the Mississippi. Here, too, the outlet was through a broad, deep valley, now partially clogged and occupied by shallow lakes and swamps, forming the divide between the drainage of the Arctic and the Gulf of Mexico.

The history of this lake is simpler and more easily understood than is that of Lake Bonneville. As the ice disappeared from the country, its front stood at successively different positions, gradually retreating northward. At one time it must have stood south of the divide between the Mississippi drainage and that of the Red River. Later, it stood on the divide, and, finally, north of the divide. It then formed a wall across a north-flowing stream and forced it to flow southward. Since the old pre-glacial valley existed with a northerly slope, a lake was formed with the two valley walls as east and west banks, the ice front as the northern boundary and the divide as the outlet, through which the mighty torrent, furnished by the melting ice, passed—a veritable Niagara in volume. When, finally, the glacier disappeared from the valley or permitted the natural northerly flow to begin, the lake dwindled down and finally disappeared, leaving only its lacustrine gravels and silts to indicate its presence; but this is sufficient, for the story is most plainly told by them. Like Lake Bonneville, its history was complicated, and at different times its surface was at different heights, since the outlet varied when the ice allowed its escape through some lower channel. Unlike Bonneville, there is one shore not now to be seen, and this is the shore line cut in the northern ice wall, and which disappeared when the ice went.

Mr. Upham estimates the area of Lake Agassiz, when it was at its highest stage, at about 110,000 square miles, and it then exceeded by more than 15,000 square miles the total area of the five Great Lakes combined. The area of the three great lakes, Manitoba, Winnepeg, and Winnipegasis, aggregate about 12,500 square miles, and they exist in the basin of extinct Lake Agassiz, being in a way descendants of that great lake, filling shallow depressions which were not filled with lake sediments. During the formation of the highest beach, the depth of Lake Agassiz was in many places as great as 500 or 600 feet. It was thus a colossal lake, greater than any now in existence on the earth.

The type of lake to which Lake Agassiz belongs is essentially extinct to-day, though it was very common on a smaller scale when the ice sheet was disappearing. Many of the north-flowing rivers of New England were thus dammed and their valleys transformed to lakes. The area of the Great Lakes was at times changed and enlarged, and their outflow was through different channels at different times. At present there are in regions of valley glaciers small lakes formed by an ice dam across a stream valley; but they are pygmies compared with Lake Agassiz, and are interesting chiefly as they show at present, on a small scale, what was formerly common on a much larger scale.

These two instances of great lakes now extinct are interesting, not only in themselves, but chiefly in showing us that the present conditions of physical geography are but stages in a great and complicated history, and not, as we are too apt to think, fixed and permanent parts of the earth. Everything in nature is changing, geographical forms no less than others. These are, perhaps, exceptional cases, showing unusually great changes in a comparatively short time; but they are, nevertheless, instructive, and may be taken as indices of other great changes of a different character, acting more slowly but, nevertheless, surely.

A Youth's Prospects in the U. S. Navy.

Boys of good character, who have no physical defect, and who can read and write fairly well, are admitted into the navy between the ages of fourteen and eighteen years. Between fourteen and fifteen years a boy must measure 4 feet 9 inches in height, and weigh not less than 70 pounds; between fifteen and sixteen, 4 feet 11 inches, and 80 pounds; between sixteen and seventeen, 5 feet 1 inch, and 90 pounds; and between seventeen and eighteen, 5 feet 2 inches, and 100 pounds. They must serve till the age of twenty-one as boys and junior seamen and after that age they rank as seamen or petty officers. They are now allowed a sum of $45 for outfit, a fact which considerably enhances the value of the service. To discover the exact number of petty officers on board a fully equipped ship is by no means an easy task; but, at all events, the number of these minor prizes is encouragingly large, while still higher up, as the final goal of the common sailor's aspirations, are the substantial berths of the four warrant officers—held by the boatswain, the carpenter, the gunner and the sailmaker—whose pay and privileges are the same as those of the junior officers. And now as to rates of pay: The pay of boys enlisted as third-class apprentices is $9 a month; the next promotion, to second-class apprentice, brings $10; the next, to first-class apprentice, $11 a month. Further on we have second-class seamen apprentices with $19 a month, followed by first-class seamen apprentices with $24 a month, these two grades corresponding respectively to ordinary seamen and able seamen, or simply seamen, whose pay is also $19 and $24 a month.

It can thus be seen that a first-class seaman apprentice and an able seaman get each the respectable sum of $288 a year, which is $128 in excess of the highest sum paid to a first-class seaman in the British service, the only other navy in the world worth consideration on the score of pay and promotion. There is, besides, the daily ration of thirty cents, which runs through the ship from the apprentice to commander, for, strange as it may appear to some people, Uncle Sam distributes just the same fare to the officers as to the apprentice, and that, too, only when on sea duty. There are no other allowances whatsoever made to the officers; they have to furnish all their own mess equipments and everything else. —*Harper's Young People.*

Motion of the Sun through Space.

Mr. A. D. Risteen, in a recently published paper in the *Astronomical Journal* on a new method for determining the direction of the sun's motion through space, concludes that he has obtained results which not only show the reality of such motion, but that its rate is 10·9 miles per second.

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Mica.

Mica fills the interstices of modern progress. A few decades ago we were seeking practical use and market for the output of mica mines already found; now we are seeking new mines to supply the multifarious uses to which mica can be applied. Thus the law of necessity changes in its relation to all things.

Mica is now as essential to the various uses of electricity as this great force is necessary to human progress. In all appliances for electrical lighting and power the most important reciprocal agent entering into their machanism is mica. All armatures are built up with its insulation, whether for dynamos, motors, generators, or transformers. Without its use as an insulation the core of the armature would burn out with a flash. But by placing sheets of mica between the thin sheets of iron, which are secured to the shaft that runs through the drum of the armature, insulation becomes perfect. Thus armatures of even the largest generators can be run for twenty-four continuous hours without heating them more than 80° Fahrenheit above the temperature of the surrounding air. By this use of mica the lines of force are dissipated, but do not lose any of their electrical energy.

In all electrical safety appliances mica also performs an important part as an insulator. To its infusible and indestructible nature much of the success of the rheostat can be ascribed. This wonderful mechanism, which is applied as a motor starter, a governor of speed, a reversing switch, and an automatic safety switch, is absolutely fireproof, and can be subjected to a red heat without mechanical injury. This is rendered possible by making the resistance of thin plates of iron packed closely together, but separated by mica.

Thus the lines of force operate on the same principle as in the armature. Aside from these important uses of mica in electrical apparatus, it is also applied to a thousand minor ones, which make it the constant and willing servant of the greatest power that man has turned to intelligent subjugation.

Mica is also an important factor in many branches of manufacture and art. Owing to its peculiar elasticity and toughness, qualities in which it is not excelled by anything natural or artificial, it is used as an absorbent of nitro-glycerine, and when so used explosions by percussion are rendered almost impossible, while at the same time nothing is taken from the energy of the nitro-glycerine when exploded by fulminates or similar device. For such purpose the plumose mica is used, or that in which the scales are arranged in feathery form.

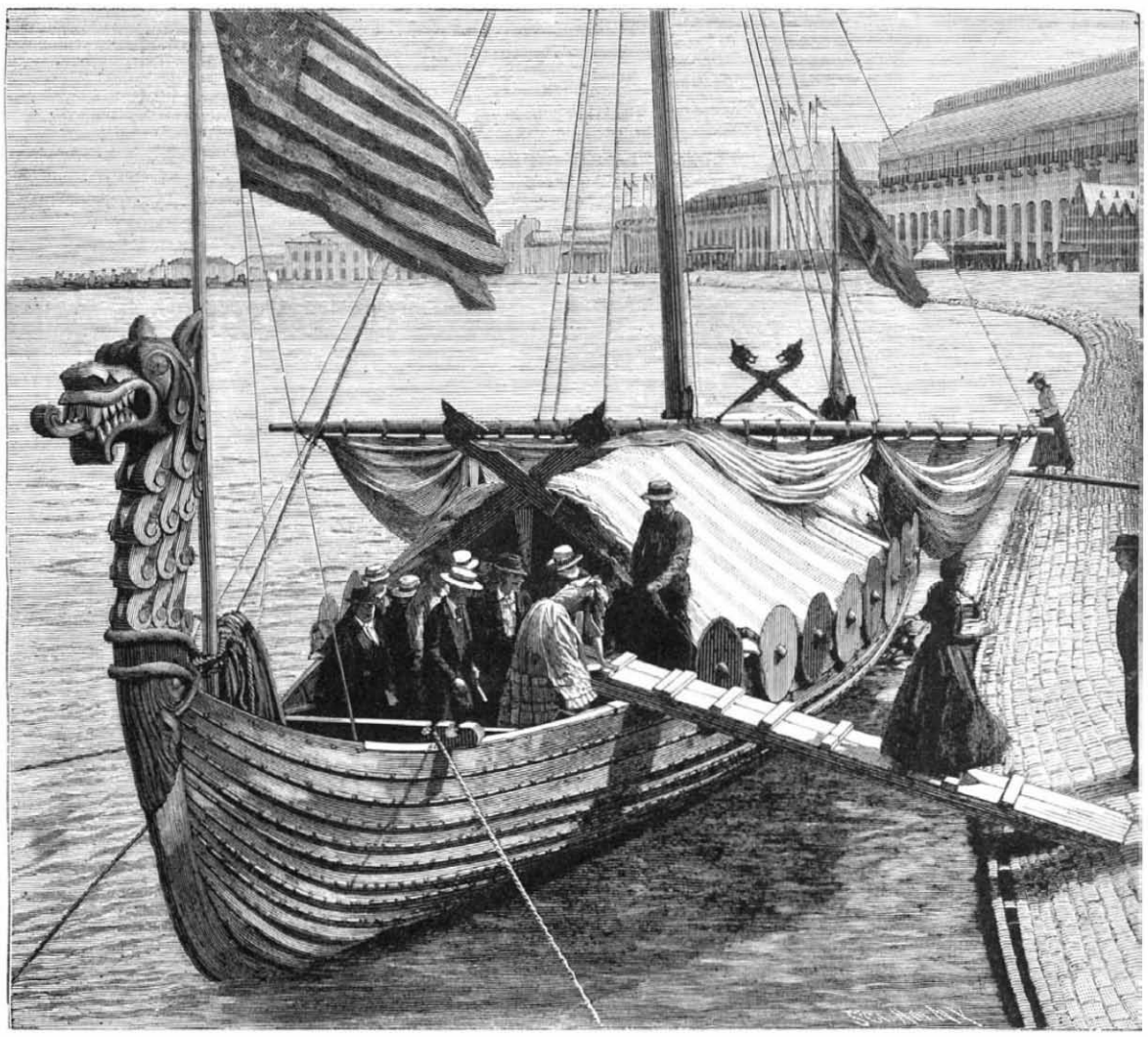
The prismatic or foliated mica is also used by passing it through a mill. This vastly increases the mica's bulk and forms masses of bran-like scales, translucent and beautiful. The French silver mouldings are also made with this ground mica. The unalterable nature of mica and the fact that it entirely resists the action of corrosive acids, smoke, and dust, make it a valuable material for edificial decoration. It can be readily colored or metalized, and its transparency preserves in all its pristine beauty anything to which it is applied. This ground mica is also used as a lubricant and axle grease, and for such purposes has no superior except plumbago. Coarsely pulverized, it is also used for roofing material and as a fireproofing for iron safes.

The cleavage of mica is so perfect it is estimated that it can be split or divided into leaves 250,000 to an inch. Much of its commercial value depends upon this wonderful property of lamination. The largest plates of mica with such foliacious structure are obtained from the Siberian mines, and they sometimes attain a diameter of five and seven feet. Crystals over two feet in diameter have been found in Pennsylvania, eighteen to twenty-four inches in New Mexico, and fourteen inches in North Carolina. Blocks of crystals weighing over one hundred pounds are frequently mined. The North Carolina mines are supposed to be very ancient.

Mica plates found in them when first discovered were trimmed to particular shapes, and it is supposed they were used for windows, mirrors, and ornaments. The number of the mines and the magnitude of these ancient operations excite wonder. Some of the mines are tunneled to a considerable length, and distinctly show marks of chisel-shaped tools. Mica in some form exists all over the earth, but not in quantities of any commercial value. It can be found in granite and quartz rubellite, green tourmaline, feldspar, lepidolite and other minerals, also in granular limestone, gneiss, and slate. It varies in color from white through green, yellowish, and brownish shades to black. Its chemical composition is silicite of alumina and potash, with a small amount of iron, magnesia and soda, and about five per cent water. —*Inter-Ocean.*

VISITING THE VIKING SHIP.

This now famous little Scandinavian vessel, only 74 feet long, which was sailed across the ocean from Norway in May last, is a constant attraction to large numbers of visitors at the Fair. She is an exceedingly well built little craft, but as to this it is said she in no way surpasses the original for which she serves as a model, and the interest in her, therefore, clearly lies entirely in the fact of her being an exact copy of one of the old Viking vessels, such as used to cruise along the English and French coasts about a thousand years ago. In this way the vessel affords one of the many valuable historical object lessons in which the Exposition abounds, and which amplify its far-reaching educational character.



THE WORLD'S COLUMBIAN EXPOSITION—THE VIKING SHIP FROM NORWAY.

Fast Ocean Steamers.

At the recent meeting of Naval Architects, London, Dr. Francis Elgar read a paper on this subject. The author sketched the history of the Great Eastern and compared her construction with that of the Campania, and then passed on to some of the general questions involved by the growing demand for increased speed at sea.

There are already several ships that can cross the Atlantic at an average speed of over 20 knots or 23 statute miles per hour. The Campania crossed from Sandy Hook to Queenstown, on her first voyage in May last, at an average of 21·3 knots, and during one day she averaged 22·3 knots. These speeds are a little over 24½ and 25½ statute miles per hour respectively. Among the conditions essential to high speed in all weathers are: (1) Great size of ship; (2) a form suitable for driving easily at high speeds over heavy seas without shipping heavy water, or lifting the propellers sufficiently to cause racing; (3) deep draught of water; (4) steadiness in a seaway; (5) great strength of structure and of machinery; (6) a large proportion of boiler power, so as to enable a full supply of steam for the engines to be easily kept; (7) a full and well regulated supply of air to the furnaces.

The speed of a ship at sea approximates more nearly to that obtained in still water, with the same propulsive power, the larger she is made. No doubt length is the principal element of size in this respect; but depth, or draught of water, is also very important. Whatever might be the speed obtained with a ship on trial in smooth water, the extent to which her average sea speed would afterward approach this would depend very greatly upon her size.

The full effect of form upon average speed at sea, over long voyages and in all weathers, cannot be measured by still-water trials.

One of the chief points in connection with the form best adapted for sea speed is that it should offer resistance to pitching. The fineness of ends that would give the best results in smooth water requires to be corrected by the fullness necessary to prevent undue pitching.

Deep draught of water is a most important element of speed at sea, and it is now strictly limited by the depth of water in the ports and docks used by the fast passenger steamers on both sides of the Atlantic. Twenty-seven feet is the extreme limit of depth to which a ship can load on either side. The Campania cannot load an inch deeper than the Umbria, although she is 100 feet longer.

Steadiness is important, not only as a very desirable element of comfort to passengers, but also as contributing to speed. When a vessel is rolling heavily from side to side, her resistance must be increased.

He concluded by saying that the improvements that would have the greatest effect in promoting the increase of speed at sea are: Increase of depth of water in harbors and docks, such as would admit of much greater draughts of water being obtained; and improvements in boilers, by which greater steam power could be developed out of the same space and weight. The Atlantic trade is increasing at such a rapid rate that larger and swifter ships are certain to be soon called for. The depth of water has lately been somewhat increased at Liverpool; but much deeper harbors and docks will be required if further great increases of speed at sea are to be obtained without excessive difficulty and cost.

The New York Aquarium.

The old historic fortress known as Castle Garden, situated on the extreme point of land at the south end of the city, where the waters of the Hudson and East Rivers unite, is now transformed into a free aquarium. The legislature appropriated $150,000 to pay for converting it, under the charge of the Park Department. The building has been remodeled by Mr. H. T. Woodman, a scientific aquarist. Round the walls and beneath a light circular gallery are two ranges of brick cells, which will form the tanks, and beneath the dome in the center of the building is a large central tank, which will in time become the home of a white whale or grampus; and six small tanks around the center tanks will be used for sharks, seals, etc. There are thirty-six side tanks in all, which will be lined with white tiles and faced with plate glass. In the gallery eighty-four small tanks will be placed. Great care is taken with the lighting, which is accomplished by means of skylights. Special tanks are provided for the blind fishes, and experiments will be carried on to see if the blind fishes will not, on favorable conditions, recover their sight. Abundant supplies of fresh and filtered salt water will be provided. The three great aquariums of the world are situated at Naples, Brighton, and Berlin. The present aquarium is much better equipped than the Berlin aquarium, and will doubtless in time rival the other two great aquariums. It is a valuable acquisition to the city.

Lead as a Coating for Iron and Other Metals.

To 100 pounds of lead are added 5 pounds of aluminum, 2 ounces salammoniac, ½ ounce arsenic, ½ ounce of borax or 1 pound of alum, and 1 pound of cryolite. The alloy of lead, aluminum, and arsenic gives a harder and more firmly adhering coat than is obtained in the ordinary process. The plates to be coated are cleaned and passed through the bath in the usual way.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

SWITCH.—John W. Tew, Rome, Ga., and John D. Riggs, Selma, Ala. This invention provides such means of locking a switch that the exercise of great power or weight will be required to effect its release, thus preventing the altering of the switch by unauthorized persons. The construction is such that when the locomotive stops with one of its wheels on a contact plate the switch will be unlocked and can be moved as desired, being closed and locked again after the passage of the train. The contact plates or tripping devices are of high tension, requiring the weight of a locomotive or car to operate them.

Electrical.

ARC LAMP.—Patrick J. Barrett, Boston, Mass. This lamp is designed to run on a low voltage current and give a very steady and brilliant light. Two or more carbons are fed downward through converging tubes, whose lower ends approach beneath the base plate of the suspending frame, the feed being very nicely controlled, and the spread of the arc being automatically regulated by a magnet through which passes the current entering the lamp, whereby the correct positions of the carbons is constantly maintained.

Mechanical.

COMBINATION TOOL.—Andrew Knudsen, Tucson, Arizona Ter. This tool comprises, in compact shape, shears, nippers, an adjustable wrench, tack hammer, screw driver, and tack puller. It is a strong, cheap, and convenient tool, having the general appearance of pliers.

MORTISING TOOL.—Simeon J. Hicks, Englewood, Ill. A hollow chisel has at its cutting end transverse cutters whose cutting edges are flush with the cutting edges of the chisel, while bits mounted to revolve in unison pass through the openings formed by the transverse cutters. The head of the tool has a reciprocating motion and slides in suitable guideways arranged on the usual mortising machine, and the tool is designed to quickly and conveniently form a complete square or rectangular mortise without danger of breaking the bits or chisel.

GYRATING BOLT.—William E. Getzs, Quincy, Ill. This is a mill bolt which is easily adjustable according to the nature of the material under treatment. In an adjustable pivoted frame are journaled shafts at right angles carrying crank arms, there being ball and socket joints on the crank arms connected with a sieve which extends parallel to the frame. The arrangement is such that every point on the surface of the bolting cloth gyrates in the same plane, and the sieve itself gyrates in the inclined position given to it by the adjusted inclination of the frame.

Mining, Etc.

CAM FOR STAMP MILLS.—Albert Ambury, Keystone, South Dakota. This cam is composed of two sections, arranged for convenient application to the revolnble shaft, without disturbing the latter in its bearings or removing the other cams on the shaft. The heels of the sections form the hub of the cam, the arrangement being such that any desired depth of hub can be given to hold the cam to the shaft, the parts being also interlocked by means of flanges.

TREATING REFRACTORY ORES.—Charles J. Fauvel, London, England. This invention provides a method of breaking up and removing any adherent skin of iron oxide from particles of precious metals in freshly roasted rebellious ores. These ores are caused to fall as a stream of incandescent particles, the falling stream being subjected to the action of jets of water crossing it at right angles, the particles falling into a running stream of water, and the particles of ore being kept out by contact with the air after they have been quenched by the water.

SKIMMER AND SWEATER.—William H. Howard, Pueblo, Col. This invention provides an apparatus for desilverizing lead bullion in the zinc pot, consisting of hinged perforated plates adapted to be passed into the zinc pot in a folded condition, and then opened and raised to carry off the zinc and silver alloy, the mechanically combined lead being sweated out when the plates are raised, and removed from the pot with the scum.

Agricultural.

ROTARY PLOW AND CULTIVATOR.—George F. Whitmore, West Union, Iowa. This is a rotatable plow or digger frame formed of a number of colter disks connected near their outer edges by radial blades or shovels to form a series of radially arranged buckets in which operate movable pans or followers forming the bottom of the buckets, and which are automatically reciprocated in the buckets to discharge the dirt after it has been elevated. A pulverizing platform is arranged to receive the dirt as it is forced out of the buckets in the colter frame which serves to crush the dirt, and drop it to the rear of the colter frame.

Miscellaneous.

AERIAL MACHINE.—Dr. S. B. Battey, No. 39 West Twenty-seventh Street, New York City. This machine has a propeller consisting of a pivoted mortar-shaped holder for explosives, adapted to swing laterally on the rear end of a cigar-shaped balloon, a feed pipe with an automatic delivery device delivering the explosive in the form of pellets to the holder at regulated intervals, the pellets being received in a yieldingly mounted receiver and ignited by an electric firing device, thus affording a powerful backward pressure upon the air to propel the machine, the discharge tube at the same time constituting a rudder. The machine is designed to be very light, having no machinery to carry, and it is claimed that a sufficient quantity of explosives to drive it several hundred miles will not add more than ten or twelve pounds to its weight. This machine was illustrated and described in the SCIENTIFIC AMERICAN of October 22, 1892, and the inventor states that the construction of a machine will be commenced at once.

BALING PRESS.—Edmund M. Ivens, New Orleans, La. This press has a main frame rotating about a fixed spindle or strain rod, with two chambers which alternately form a cotton-receiving and a compressing compartment, the arrangement being such that while the cotton in one chamber is being baled the other chamber will be receiving a fresh supply of cotton, the frame being turned after the bale is removed so that the empty chamber is brought under the cotton-supplying devices and the last filled chamber over the compressing devices.

Another patent by the same inventor provides a rotatable press box having dual compartments in which are arranged counterbalanced followers adapted to be held in any of their intermediate adjusted positions by hydraulic power, there being simple means operated by the presser platen feed mechanism for swinging the press box. There is also a variable and accumulative presser platen feed mechanism, whereby the bale can be treated to a plurality of presser applications of different speed and accumulated power.

DUMPING SCOW.—Patrick Ryan, New York City. This boat has a flat-bottomed hull, with a downward slope on each side edge of the main deck, there being at the angle at which the slope commences lengthwise-extending rock shafts which sustain tilting tables adapted to receive the load. The tables are strongly braced by stay rods, and at each end of the scow, mainly below decks, is a ratchet and lever mechanism to tilt the tables for the discharge of the load, the tables being tilted simultaneously or successively as desired.

SEWER CLEANING APPARATUS.—Alfred Mundell, Brooklyn, N. Y. By means of a windlass a cable or rope is drawn through the sewer from one manhole to the other, and to the cable are attached buckets, one behind another, the lower side of each bucket being prolonged to act as a scraper. Means are also provided for raising the buckets at the manholes without injury to the sewer construction, and the entire apparatus is designed to facilitate the rapid removal of all sediment from a sewer at a minimum expense.

ANTI-RATTLER.—William H. Pardee, Antigo, Wis. Combined with a thill coupling having the usual clip and knuckle is a spring lever fulcrumed beneath the knuckle and held to press against it, a ball pivoted to the free end of the lever hooking over the back end of the clip plate, while there is a cam mechanism for moving the ball and spring lever. The device is simple, cheap and durable, and may be applied without the use of tools to an ordinary thill coupling, effectively taking up all lost motion and preventing any rattling.

SPRING BED.—Olin R. Gould, Dayton, Iowa. Upon the slats of the frame are held spiral springs of different sized wire, with strengthening cross spiral springs, the arrangement being such that the springs mutually support and brace each other, forming a cheap, strong and simple bed, which has an even and flat surface, and which offers an extremely easy surface for one to lie upon.

BED BRACE.—William H. Fitzgerald, Monroe, N. C. This is a stretching device for flexible strands attached to the side rails and corner posts, comprising an elongated bracket block, two grooved pulleys, a handle piece, with lug, and a right and left hand screw engaging threaded holes in the handle piece and in the bracket block. It may be quickly applied to any open bedstead, to stiffen it in all directions of strain, thus rendering a light bedstead comfortable and safe.

JUMPER AND APRON.—Thomas R. Chambers, Brooklyn, N. Y. This is a combination garment for workmen, having guides at each side of its rear opening, and tapes crossed and passed through the guides, whereby the garment may be quickly and easily secured upon the person, and will admit of the wearer assuming any posture that might be taken when an ordinary jacket was worn.

SUSPENDERS.—Jacob H. Bley, New York City. The suspender ends are, according to this improvement, formed of bent braid, while the shoulder straps are jointed at the rear and a rear suspender end is formed of a single bent braid having part of its adjacent edges fastened together to form a head, which is secured to the shoulder straps at their rear joint. Strong and secure ends are thus formed and the usual attaching plates for the rear ends are dispensed with.

BIRD CAGE FOOD HOLDER.—Louis F. Shanovski and Barnet Rubenstein, Chicago, Ill. This holder is composed of wire bent to form base and side rods, hangers and a spring clasp, a brace or medallion connecting the side rods. The improvement avoids bending the wires of the cage and keeps the food clean and in good condition, being adapted to securely hold lumps of sugar, crackers, fruit, cuttle bone, etc.

DISH CLEANER.—Walter A. Adams, Hogan, Montana. This cleaner has an outer part similar to an ordinary dish pan and an inner dish-receiving receptacle made of wire or perforated sheet metal, there being on the bottom of the latter a ring-like plate carrying a series of rollers. The inner receptacle, when filled with dishes, is rapidly rotated by means of its handles, after having been placed in the outer receptacle, containing hot water and the cleansing compound, a similar rinsing with clean water following.

STOVEPIPE HANGER.—William H. Trepns, Chicago, Ill. An adjustable band encircles the stovepipe, and from one side of this band extends a rod held adjustably in a sleeve, a plate supporting the sleeve being adapted to be fastened to the ceiling or other support. The device is strong and simple, and readily applied and adjusted to hold the pipe in the desired position.

FIRE LIGHTER.—Peter Peschong, Alton, Iowa. This is a device comprising an outer metallic chamber and an inner sheet metal receiver within which is held another receiver adapted to contain a chemical by which a fuse may be ignited to light the fire, the ignition being made to take place by means of a clockwork mechanism at any predetermined time, the combustibles having been previously arranged in the stove or grate. The device is designed to be entirely reliable and quite inexpensive.

POCKET BOOK.—Isaac Scheuer, New York City. A flat spring is secured to the stationary bar of the frame of a pocket book, satchel or similar article, and the free end of the spring has a head fitting into a transverse slot formed in the bar, the head having on its under side a keeper for engagement with the catches held on the hinged sides of the frame. The device permits of conveniently locking both sides of the article without presenting any projection on the frame.

TAG FASTENER.—Samuel E. Adams, Washington Court House, Ohio. This is an exceedingly simple device, especially adapted for securing price tags on bolts of goods, or attaching a tag to goods of any description. It consists of a plate having a loop for the reception of a tag, a needle point projecting from the upper surface of the plate near the front, and a second needle point extending from the lower surface of the plate near the rear, the second needle point being in the form of a hook.

DENTAL ARTICULATION CUP.—George K. Bagby, New Berne, N. C. This invention provides a cup having outer and inner arched walls, with connecting ribs, the outer wall having a hinge and the inner one a flexible sheet, both on the median line to adapt them to different widths of jaw. By means of the improvement the dentist can take an additional impression for the articulation or bite at the same sitting that he takes the impression for the plate.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE LOCOMOTIVE CATECHISM. By Robert Grimshaw. New York: Norman W. Henley & Co. London: E. & F. N. Spon. Pp. 362. Price $2.

Robert Grimshaw, widely known as an author on technical subjects, has acquired much of his success from works written in the forms of catechisms or of question and answer. In his treatment of subjects he has a peculiarly crisp and graphic style, which lends itself well to the question and answer treatment, which is adopted in this book. The exhaustive nature of it is evident from its large number of questions, nearly 1,300 in number, each of which is clearly and simply answered. The selection of questions is interesting, the author in his preface stating that novices and expert locomotive engine runners have selected many of them and examining engineers have selected many more. As regards the illustrations, there is nothing to be desired. They are not only most elegantly produced, but have a special value in being derived from the last examples of practice. The author possessed unusual facilities for procuring drawings of the most recent types, and of these facilities he has availed himself to the fullest extent. The proof that the work is up to the present date is shown by the fact that a cut of the famous engine "999," drawing the World's Fair special, is given. Numerous folding plates are contained, each in itself being virtually a working drawing. One of these plates is devoted to the same engine "999," so that the possessor has at once the pictorial and constructive drawings of this last example of modern locomotive building. The subject of accidents is treated to a considerable extent.

BRITISH FOREST TREES AND THEIR SYLVICULTURAL CHARACTERISTICS AND TREATMENT. By John Nisbet. London and New York: Macmillan & Co. 1893. Pp. xvi, 352. Price $2.50.

America is so much a better field for arboriculture than England that it is to be supposed that this book will be of equal interest and value to the American reader as to the British reader for whom it is especially written. The woods of the two countries are very nearly the same, and so systematic and excellent a treatment of the subject of forestry will be warmly welcomed by all.

GRAVITATION THE DETERMINING FORCE. By Ethan Samuel Chapin, A.M. Cambridge: Printed at the Riverside Press. 1887. Pp. xiv, 169. No index.

The author of this book claims that more than twenty years ago he was logically driven to conclusions which have recently been reached by advanced scientists. The work does not lend itself easily to a review. To the students of cosmic science it will no doubt be quite interesting.

CONTRIBUTIONS FROM THE LICK OBSERVATORY. No. 3. Terrestrial Atmospheric Absorption of the Photographic Rays of Light. By J. M. Schaeberle. Sacramento: State office. A. J. Johnston, Supt. State Printing. 1893. Pp. 90.

In this, the third contribution from the Lick Observatory, a subject of much interest to the astronomer is very fully developed, and to such it will be found a manual of special interest and value.

THE YOSEMITE, ALASKA, AND THE YELLOWSTONE. By William H. Wiley and Sara King Wiley. London: Offices of *Engineering*. New York: John Wiley & Sons. Pp. xix, 230. Price $4.

The admirable graphic style of the text of this description of Western travel, the numerous illustrations, independent of the personal associations of the author so widely known, make it an excellent contribution to the topographical story of our country. Although full of anecdote and graphic to the last degree it possesses a true scientific value from the numerous data included in it, the review of the progress of the great West and its history. Many illustrations are exceedingly striking, notably the interior view of the Mormon Tabernacle, with its elliptical vaulted roof. It is needless to say that the work is in the best character from the bookmaking standpoint, and the entire aspect is such as to make one wish for more such work from the same hands. In the preface written by Mr. J. Dredge the superfluity of any introduction to the American public of this book and its authors is rightly noticed. To the British public the book itself, Mr. Dredge states, will be the best introduction. Mr. Dredge's part in the matter appears in its having been originally published in London *Engineering*. An excellent portrait of Mr. Wiley forms the frontispiece. The author covered some 10,000 miles in his trip, penetrating as far as Alaska.

THE SLIDE RULE. Third Edition. By William Cox. New York: Published by Keuffel & Esser Co. Pp. 14. Price 50 cents.

This description of what can be done with the slide rule is exceedingly clever, and it is astonishing to find how much work can be done by this simple instrument. The work is very concise and gives information in excellent shape.

THE BOOK OF THE FAIR. An Historical and Descriptive Presentation of the World's Science, Art and Industry, as Viewed through the Columbian Exposition at Chicago in 1893. By Hubert Howe Bancroft. Chicago and San Francisco: The Bancroft Company. 1893. Pp. 40. Price $1.

This is the first installment of what will eventually be a very superb monograph on the World's Fair. It is profusely illustrated and the entire work, when completed, bids fair to be one of the most important contributions to be made to Chicago's effort.

SANITARY ENGINEERING IN INDIA. For the use of municipalities and engineers. By John Wallace. Bombay: Printed at the Education Society's Steam Press. 1893. Pp. vii, 238, xi. Price $3.25.

India would certainly seem to be an excellent field for the sanitarian. The author gives somewhat startling examples of the vile sanitary conditions of life among the natives, and the work should certainly find a place in the laboratory of the sanitary engineer. It is of some interest to know that it is printed in Bombay, as it affords an illustration of the printing industry as conducted in British India.

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SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST, 1893.—(No. 94.)

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1. Elegant plate in colors, showing the villa erected for J. Armoy Knox, at Primrose Park, Mount Vernon, N. Y., at a cost of $14,928 complete. Floor plans and two perspective elevations. An excellent design.
2. Plate in colors showing the colonial residence of L. Allyn Wight, at Montclair, N. J., erected at a cost of $15,400 complete. Perspective view and floor plans. Messrs. McKim, Mead & White, architects, New York. An attractive design.
3. A cottage erected at Portland, Me. Perspective view and floor plans. A model design. Cost $3,400 complete. Mr. J. C. Stevens, architect, Portland, Me.
4. A Queen Anne cottage, erected at Wayne, Pa., at a cost of $6,000 complete. Floor plans, perspective view, etc. Messrs. F. L. & W. L. Price, architects, Philadelphia, Pa. An excellent design.
5. Engraving and floor plans of a dwelling recently erected for A. B. Root, Esq., at Springfield, Mass., at a cost of $3,500 complete.
6. Engraving and ground plan of Grace Episcopal Church, at Plainfield, N. J., erected at a cost of $40,000, complete. Mr. R. W. Gibson, New York City, architect.
7. A dwelling recently completed at Brookline Hills, Mass., at a cost of $5,120, complete. Perspective elevation and floor plans.
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9. Wood and stone dwelling at Narberth, Pa. A unique design. Perspective elevation and floor plans. Estimated cost $5,000, complete.
10. Design for a village library.
11. The Fifth Avenue Theater, New York. View of the family circle and of the handsome drop curtain. Mr. Francis H. Kimball, architect, New York.
12. A suggestion in corner decoration. Bay window decorations.
13. Miscellaneous contents: Wiring of buildings for electric lights.—Montauk club house, Brooklyn, N. Y.—A novel system of domestic water supply, illustrated.—Wood mantels and ornamental fireplaces, illustrated.—Fencing made of sheet metal, illustrated.—The Hartman sliding blind; view of factories.—An improved dimension saw, illustrated.—Plumbers' and steamfitters' supplies.—The Capitol hot water heater, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(5268) W. P. M. says: I am making a water tube boiler on the porcupine plan. Is there any objection to using pipe for the porcupine as small as half an inch, where the pipes will be two feet long? A. Half inch tubes, 2 feet in length, are too small for a porcupine boiler; the circulation will be sluggish and cause the boiler to lift its water by the accumulation of steam in the small tubes, so fast as to push the water out. The fouling of small tubes is also an objection. Not less than 1 inch tubes should be used, with as large standpipe as possible; will make the best working boiler. 2. As regards speed, are hollow or straight water lines desirable for a steamboat? A. The concave bow and stern water lines or wave lines are the lines for speed. 3. I am using in my launch an oil-burning boiler. Oil is fed to boiler by steam, which is very objectionable for many things, especially noise. Can you tell me a simple way to make a vaporizer so that I can burn oil in the form of vapor instead of spray? A. There is no method of burning oil under a boiler better or safer than the jet spray, either air or steam. The air jet makes the cleanest fire, but the combined steam and air jet is most convenient and in general use. The steam and air jet has not been considered objectionable when properly regulated; perhaps your steam nozzle is too large and carries too little air into the fire chamber; try a smaller steam nozzle combined with an annular air nozzle for the atomizer.

(5269) N. L. T. writes: 1. In an alternating transformer what will be the relative amperage and E. M. F. of current in the secondary coil as compared to that of the primary, supposing both coils being of the same length and size of wire and both wound alike upon an iron ring or continuous core? A. The relative voltage of primary and secondary is in the ratio of the number of turns of wire in the same. The same number of turns gives the same voltage. There will be a loss in amperage in this case of about 10 per cent. 2. In what ratio does the increase of the frequency of alternations in the primary increase the E. M. F. or tension of the induced current? A. There is no connection. 3. Will a resistance in the secondary circuit have the same effect upon the primary current as if the same resistance were placed in the primary circuit? A. It will have what is practically the same effect by developing counter E.M.F. 4. Will you please explain in an analogous way the meaning of the expression self-induction and capacity? A. Self-induction is electric inertia. A current requires time to be fully started and time to cease. Capacity refers to the quantity of charge retainable at a given pressure (voltage). This is analogous to storing compressed air. 5. Can you mention any substance transparent to heat or light waves, or to both, and having some electrical conducting power and which will retain the solid form or withstand heat up to say 200° Fah.? A. There is no such substance. The general rule is that conductors of electricity are not capable of transmitting light waves.

(5270) W. H. F. says: 1. I wish to make a compass 12 inches long; can I use a common horse shoe magnet to magnetize the needle, and how should I draw the needle on the magnet? A. Stroke it from end to end, always in the same direction, with one pole of the magnet, returning the magnet through the air. 2. I want to make a helix to magnetize a ⅝ steel bar, 5 inches long; what number wire must I use and how many layers on the helix, and how many gravity batteries should be used, and how must the bar be fastened in the helix? A. No. 20 wire is a convenient size. There are no fixed dimensions. Gravity batteries are of rather high resistance. The wire may be wound directly on the bar. 3. I have a zinc box in a case 12 inches deep, 10½ inches diameter, 2¼ inches wide, and carbon for same. What preparation can I use for a dry battery of same? A. For dry batteries we refer you to our SUPPLEMENT, Nos. 157, 767, and 792. 4. A few days ago a cousin of mine photographed a kite. In the negative are four perfect kites. A. We should like to see print from the negative. No judgment can be given without this.

(5271) N. L. M. asks how to preserve bird skins. A. Make an incision from the breastbone to the vent with a small piece of wood work the skin from the flesh. When the leg is reached, cut through the knee joint and clear the shank as far as possible, then wind a bit of cotton wool on which some arsenical soap has been put round the bone; do the same with the other leg. Now divide spine from root of tail, taking care not to cut too near the tail feathers, or they will come out. Next skin the wings are far as possible and cut off. The skin will now be entirely clear of the body. The skin must now be turned inside out and the neck and skin gently pulled in opposite directions till the eyeballs are fully exposed. The whole of the back of the head may be cut off and the eyes and brains taken out and their places filled with cotton wool. The whole skin should be rubbed well with arsenical soap or plain arsenic, and the neck returned to its natural position, when, after filling the body with a little dry grass or wool, the job is done. It is very easy, and the skin of a bird is much tougher than one would suppose, though of course they vary, the night jar being very thin, while humming birds are fairly tough. All the apparatus required is a sharp knife and a pair of scissors, or, for large birds, a strong pair of nippers to divide the bones. From the "Scientific American Cyclopedia of Receipts, Notes and Queries."

(5272) W. L. C. writes: To settle a dispute between myself, a city editor, and a learned gentleman, I wish you would answer this: Is the Pacific Ocean along the coast from Lower California to Puget Sound rougher sea, harder to sail on, and more liable to angry waves than the eastern or Atlantic coast of the United States? If so, why? Are the California, Oregon, and Washington ports harder to enter by reason of rough sea than from Maine to Florida? A. The prevailing winds along the Pacific coast of the United States are westerly, or on-shore winds, while the prevailing winds on the eastern coast are also westerly, or off-shore winds. An on-shore prevailing wind makes a rough sea along a coast and at the entrance of harbors, especially so where there are bars at the entrance. An off-shore wind insures a comparatively smooth sea along a coast and easy access to harbors. The storm winds temporarily change this condition, but it is the prevailing winds that give the peculiar character to the two coasts as regards the roughness of the sea and the difficulty of navigation along the coasts and entrance to shallow harbors. The month of the Columbia with its bars is a noted example on the Pacific coast.

(5273) D. H. asks how to clean ornamental bronze door knobs and plates, light finish, also how to keep them bright. A. The finish of this class of work is done by dipping in strong nitric acid or compounds of dipping acids, then washed in clean hot water and dried. The bright parts are then burnished and the articles lacquered with various colored lacquers for the required shade. Such work should never be cleaned; it destroys the lacquer coat and the recesses of the ornamentation become foul. It should be sent to a finisher of such work for renewal of the lacquered surface.

(5274) A. A. P.—To smooth parchment which has become wrinkled, place the parchment face downward upon clean blotting paper. Beat up to a clear froth, with a few drops of clove oil, the whites of several fresh eggs, and with the fingers spread this over the back of the sheet and rub it in until the parchment becomes smooth and yielding. Then spread it ont as smooth as possible, cover with oil silk and press for a day. Then remove the silk and cover with a linen cloth and press with a warm iron.

(5275) L. D. S. asks how to make the tin tree. A. 1. Chloride tin, 3 drm. 2. Nitric acid, 10 drops. 3. Piece of zinc attached to copper wire. Put No. 1 into a glass vessel with sufficient water to 8 parts fill, then add No. 2, shake well until dissolved. Now place No. 3 through a cork and insert in solution, so that no part shall touch top, bottom or side of glass vessel. Let the whole rest quietly for a short time. The tree will grow and have a very lustrous appearance.

(5276) J. M. H. asks where the worms we see on sidewalks after a rain come from. I have heard it stated that they fall with the rain, but to my ears that explanation seems hardly plausible. Are there any well authenticated accounts of rains of frogs, etc.? A. The worms and frogs or toads come from their holes or hiding places in the soil during rain, either driven out by the water filling their holes, or perhaps for a bath. There are no authentic accounts of the falling of worms, fishes, or toads from the atmosphere, unless as the result of a tornado.

(5277) F. A. says: We send you a bug for examination, found on our featherbeds. We are thinking it is more troublesome to a man than the mosquitoes or bedbug, and we would like to know its nature. Answer by C. L. Marlott, Acting Entomologist.—The insect mentioned as occurring in featherbeds is one of the common snapping beetles or spring beetles known as *Athous fossularis* Lec. Its appearance on the bed was simply accidental, as it was undoubtedly attracted to the room by light.

(5278) F. K. J. asks: How can I get the rust out of wrought iron water pipes? They are in the ground about four years, and the water runs through them about half as strong as at first. A. The pipe cannot be cleaned while in the ground; it must be taken up and the rust cleaned out with an iron rod, or lay new galvanized iron pipe, which does not rust.

(5279) R. L. S.—About 166 feet of gas can be made from a gallon of gasoline?

(5280) F. A. K. writes: Please settle a dispute by answering the following in your Notes and Queries: A holds that when a person in Australia or any other place south of the equator is looking at the sun at noon he will be facing north; or in other words, the north side of the street is the shady side at noon. B holds that sun is always south of a person at noon, no matter what part of the earth he is on. Who is right? A. A is partially right and B is wrong. To a person south of the tropic of Capricorn, or in southern Australia, the sun is always north of his zenith and casts his shadow to the south; and if he is north of the tropic of Cancer, the sun is always south, and casts his shadow toward the north at noon. To a person within the tropics the sun's shadow may be north or south, according to the sun's declination from his zenith.

(52 1) C. K. asks: How long will it take a storage battery current to decompose a pint of water into its gases? How many volts are required to separate it in five minutes? What is the most convenient form of apparatus to do this work? A. To decompose water it is well to allow two volts difference of potential. An ampere for five minutes is 300 coulombs, which will decompose 0·86 grain of water. The number of cells required to decompose a pint of water must be deduced from their amperage as given by the makers of the cell. For apparatus use copper or iron electrodes and a dilute solution of caustic alkali as electrolyte.

(5282) W. H. C. says: Will you please explain the way that nails are graded, just what is meant by a tenpenny, a ninepenny nail, also what is the relation between the length and name of nail? A. We give the name, size, and weight of nails as follows:

Threepenny	1·25 in. long	420 per lb.
Fourpenny	1·8 " "	270 " "
Fivepenny	1·75 " "	220 " "
Sixpenny	2· " "	175 " "
Eightpenny	2·5 " "	100 " "
Tenpenny	3· " "	65 " "
Twelvepenny	3·25 " "	52 " "
Twentypenny	3·5 " "	28 " "

The lengths are standard for all kinds, but the number to a pound varies with different makers and for the different kinds, as ordinary, light, and finishing nails.

(5283) W. L. R. says: We have a horizontal tubular boiler 10 feet long, 36 inches in diameter, with 90 flues 3 inches in diameter. Also a 20 horse power engine, 9×12 cylinder, making 200 revolutions per minute. How many pounds pressure of steam are necessary to develop the full 20 horse power? A. The boiler is nominally 20 horse power. Its effective horse power may be much larger with high pressure. The required boiler pressure for 20 indicated horse power of the engine will be governed by the point of cut-off, which if ⅛ will require 45 pounds boiler pressure. If ¼ cut-off, 40 pounds pressure. If ½ cut-off, 35 pounds pressure.

(5284) R. S. asks: If there are fifty incandescent lamps connected up in series, voltage 110, amperes 6-10 for each, resistance in ohms 168 for each lamp, will the last lamp burn as bright as the first one, and what is the cause? A. Yes; because each passes the same current. The current effects the heating of the filaments.

(5285) P. H. H. writes: I have two ammeters, and when I connect them together they do not register the same. Is there any way of adjusting them without having a standard instrument to go by? A. If you can secure an absolutely constant current, then you can determine its amperage by a silver ampere-meter. The method, a very simple one, is given in Ayrton's "Practical Electricity," which we can supply for $2.50. Such a current can be used to standardize your ammeters.

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August 8, 1893,

AND EACH BEARING THAT DATE.

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Hame fastener, I. Pennington 502,862
Harvester conveyer belt, D. W. Storms 503,014
Harvester, cotton, B. Gause 503,041
Harvester, pea, J. Bearman 503,031
Harvesting machine, E. A. Peck 502,861
Hasp lock, C. S. Van Auker 502,938
Hay press, A. Witte 502,942
Hay sling, L. J. Helland 502,721
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Heater, H. W. Campbell 502,701
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Hinge, spring, F. D. Robinson 503,064
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Holdback, vehicle, J. F. Haines 502,718
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Horseshoe, two-part, W. G. Clabasey 502,843
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Hydraulic accumulator, W. Krutzsch 503,091
Hydraulic elevator, electrically operated, E. Marshall 502,980

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Hydrocarbons from bituminous rocks, method of and means for extracting, G. Archbold 503,028
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Jack. See Boot or shoe jack.
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Joints, mould for making plumbers', F. Tyers 502,893
Journal lubricator, car, S. Walker 502,018
Kettle, rendering, Gloekler & Munroe, Jr. 502,714
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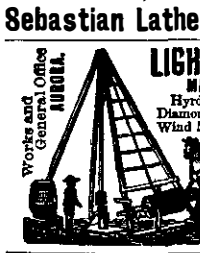

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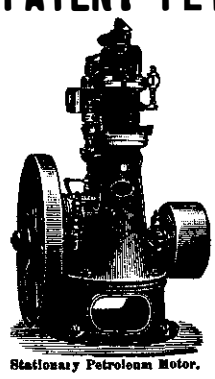

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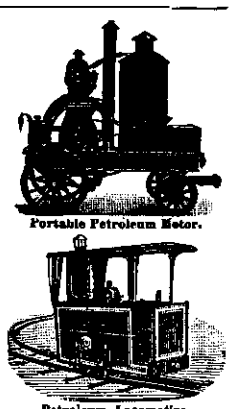

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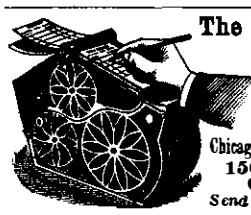

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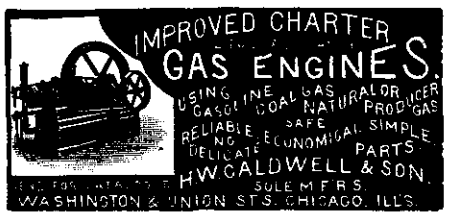
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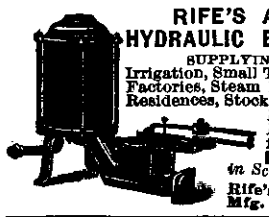

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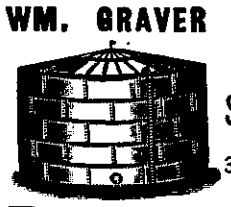

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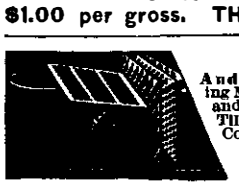

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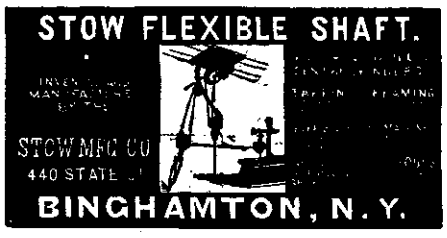

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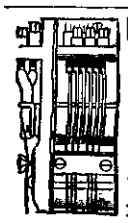

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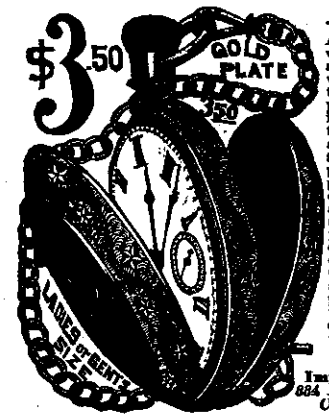

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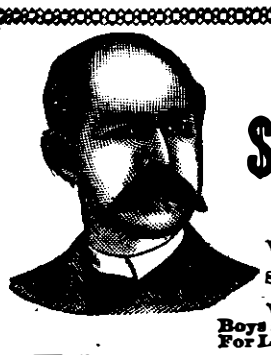

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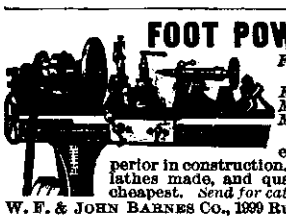

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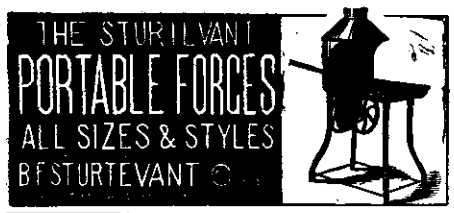

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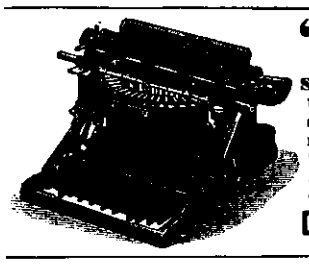

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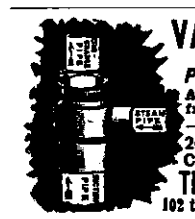

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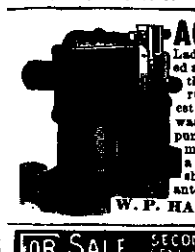

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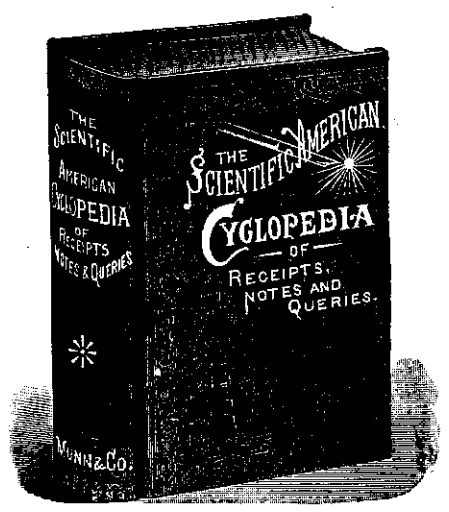

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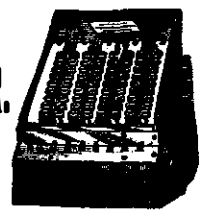

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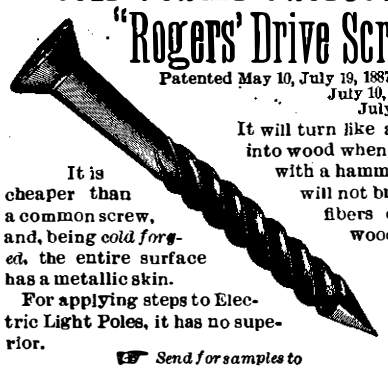

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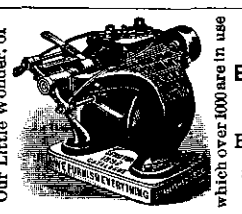

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